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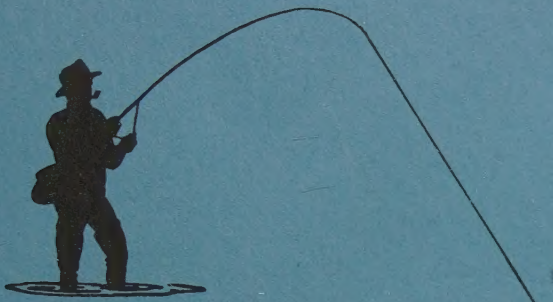

SPORT FISHERY ABSTRACTS

Vol. 18, No. 3, 1973

Abstracts 16335 - 16684

DEPARTMENT OF THE INTERIOR

U. S. FISH AND WILDLIFE SERVICE

BUREAU OF SPORT FISHERIES AND WILDLIFE

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SPORT FISHERY ABSTRACTS

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Sport Fishery Abstracts is intended to furnish fishery biologists in government agencies and educational institutions with abstracts of the current literature in sport fishery research and management. Abstracts of published articles on limnology, ecology, natural history and other fields of specialization are included when the subject has application to the conservation and management of sport fishery resources.

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16335. Leach, J. M., and A. N. Thakore (B. C. Research, 3650 Wesbrook Crescent, Vancouver 8, British Columbia, Canada). 1973. IDENTIFICATION OF THE CONSTITUENTS OF KRAFT PULPING EFFLUENT THAT ARE TOXIC TO JUVENILE COHO SALMON (Oncorhynchus kisutch). J. Fish. Res. Bd. Canada, 30(4): 479-484.

The nonvolatile constituents that are acutely toxic to juvenile coho salmon (Oncorhynchus kisutch) have been fully identified in a kraft pulping effluent derived from Douglas fir and western hemlock. Toxicity and material balances were maintained throughout a fractionation procedure leading to isolation of the toxic factors. Over 80% of the toxicity was caused by three resin acid soaps: sodium isopimarate (55%), sodium abietate (22%), and sodium dehydroabietate (5%). The remaining toxicity (18%) was contributed by sodium salts of the unsaturated fatty acids: palmitoleic, oleic, linoleic, and linolenic. (Authors)

16336. Giger, Richard D. 1972. ECOLOGY AND MANAGEMENT OF COASTAL CUTTHROAT TROUT IN OREGON. Fishery Research Report No. 6, Ore. State Game Comm., Corvallis, Oregon, 61 p.

Hatchery and wild stocks of coastal cutthroat trout were studied from 1965 to 1970 on the Alsea, Siuslaw and Nestucca rivers in order to provide information for improved fishery management. Seawater tolerance, growth and age, survival, population size, migrations, estuarine distribution, and catch were examined for one or both groups of cutthroat through laboratory studies, fishery monitoring, netting and tagging, and other methods. A number of commonly used live-capture techniques failed to take substantial numbers of cutthroat in estuary areas as desired, and a resultant, achieved goal of the study was the development of suitable capture gear. (From author's summ.)

16337. Wenger, Alan (Inland Fisheries, Texas Parks and Wildlife Dept., Sheldon, Texas). 1972. A REVIEW OF THE LITERATURE CONCERNING LARGEMOUTH BASS STOCKING TECHNIQUES. Technical Series No. 13, Texas Parks & Wildl. Dept., Sheldon, Texas, 40 p.

Although the general goal of stocking artificial lakes and ponds in all cases is to produce good fishing, there has been disagreement about what type of population produces this condition. There has also been disagreement about how a desirable population can be achieved through stocking. The goal of the stocking procedures developed primarily by H. S. Swingle in Alabama was to produce "balanced populations." Balanced populations were defined as populations that yield annual crops of harvestable fish that are of satisfactory size when the fertility of the water is taken into consideration. On the basis of experiments, it was concluded that the largemouth bass Micropterus salmoides (Lacépède), stocked in combination with bluegills, Lepomis macrochirus (Rafinesque), or stocked in combination with bluegills and redear sunfish, L. microlophus (Günther) were the best stocking combination for obtaining a balanced population. Swingle believed that there is a direct relationship between bass and the fish they prey upon. This is one of the primary reasons that he believed definite stocking rates and ratios should be used. George W. Bennett did not believe that there is a direct relationship between bass and the fish they prey upon because bass do not feed exclusively on fish. In contrast to Swingle, he did not consider stocking rates and ratios to be very important in determining the final outcome of stocking. George W. Bennett came to the conclusion that interference by small fish with (1) the reproductive activities of bass and (2) the survival of largemouth bass fry, may be the most important factor causing poor bass populations in Illinois. He believed that stocking bass alone showed promise. Henry A. Regier evaluated stocking bass with bluegills and stocking bass with golden shiners in New York. The bass-bluegill combination was not believed to be a good combination for the average pond owner because this combination apparently required management to be successful in New York. Regier believed that the bass-golden shiner, Notemigonus crysoleucas (Mitchill), combination is a better combination for most pond owners. The largemouth bass-bluegill combination was tested by other workers as were combinations involving largemouth bass stocked with other species and largemouth bass stocked alone. The results of stocking of the largemouth bass-bluegill combination were mixed. Redear sunfish;

redear sunfish x green sunfish, Lepomis cyanellus Rafinesque, hybrids; and golden shiners were each believed to show promise as companion fish for largemouth bass. It was also found that when largemouth bass are stocked with channel catfish, Ictalurus punctatus (Rafinesque), the survival of catfish will be very poor unless they are too large for the bass to eat. Much of the disagreement over the success or failure of the largemouth bass-bluegill stocking technique is apparently the result of the individuals doing the stocking having different goals. The primary pond stocking problem to be solved is the development of a stocking procedure that will produce satisfactory fishing over a number of years for the pond owner who does not manage his pond. (Auth.)

16338. Karnella, Charles (National Systematics Lab., NMFS, NOAA, Washington, D. C.) 1973. THE SYSTEMATIC STATUS OF Merluccius IN THE TROPICAL WESTERN ATLANTIC OCEAN INCLUDING THE GULF OF MEXICO. NOAA Fishery Bulletin, 71(1): 83-91.

Several morphometric and meristic characters are used to compare populations of Merluccius from the Gulf of Mexico and Atlantic Ocean. Both populations are shown to have similar values for all characters studied. As a result M. magnoculus Ginsburg is relegated to the synonymy of M. albidus (Mitchill). Geographical variation is noted in many of the characters investigated. (Auth.)

16339. Boyer, Ronald L., and Louis E. Vogele (So. Central Reservoir Investigations, Bur. Sport Fish. & Wildl., Fayetteville, Arkansas). 1971. LONGEAR SUNFISH BEHAVIOR IN TWO OZARK RESERVOIRS. Reprint from Reservoir Fisheries and Limnology, Spec. Publication No. 8 of the Amer. Fish. Soc., pp. 13-25.

Spawning behavior, agonistic behavior and comfort movements of longear sunfish, Lepomis megalotis (Rafinesque), were observed in Beaver and Bull Shoals Reservoirs. Spawning colonies were generally found in brush-free areas having a gradually sloping gravel substrate. The spawning season began near the end of May when water temperatures at nest depths reached 21 to 23 C. In one instance, a second spawning period began two weeks after the first spawning ended. Nest depth ranged from 0.2 to 3.4 meters with an average depth of 1.5 meters. Average nest diameter was approximately 0.5 meters. Females frequently spawned in more than one nest and often more than one female was observed spawning with the same male. A typical nesting cycle lasted nearly two weeks with all eggs hatched within one week. Twelve nests in varying stages of development contained 52 to 2,836 eggs and/or larvae. Enumeration of nests with hatching eggs indicated greater nesting success in Bull Shoals Reservoir than in Beaver Reservoir. Males guarded the nests until the larvae departed and, while defending the nests, fed on food items in or adjacent to them. Females apparently consumed little food immediately before and during spawning. Males were observed consuming eggs from their own nests. Barrel trap catches indicated that longear sunfish maintain a greater degree of residency at normal reservoir levels than during periods of high water. (Authors)

16340. Reynolds, James B., and G. M. DeGraeve (Great Lakes Fish. Lab., U.S. Bur. of Sport Fish. & Wildl., Ann Arbor, Michigan). 1972. SEASONAL POPULATION CHARACTERISTICS OF THE OPPOSSUM SHRIMP, Mysis relicta, IN SOUTHEASTERN LAKE MICHIGAN, 1970-71. Proc. 15th Conf. Great Lakes Res., pp. 117-131, Internat. Assoc. Great Lakes Res.

This study of depth distribution, abundance, growth, reproduction and standing crop of the opossum shrimp, Mysis relicta, in southeastern Lake Michigan was based on monthly samples collected from August 1970 through July 1971 (except February and March). Population density was usually low at 10-20 fathoms, moderate at 25-30 fathoms and relatively high at 35 fathoms and deeper. Abundance was highest in midsummer and lowest in December. Free-living mysids were 3-25 mm long. Average growth rate was 1 mm per month. At maximum lengths, females were longer than males. Weight increased as approximately the cube of the length. The population consisted mostly of juveniles during summer and autumn and subadults and adults in winter and spring. Sizable numbers of

adults apparently moved to relatively shallow water (10-35 fathoms) in winter, where they bred and released their young. In deeper water (40 fathoms or more), some reproduction occurred throughout the year. Most recruitment was in April and May. Standing crop ranged as high as 50 kg per hectare. Mysis apparently has a one-year life cycle in southeastern Lake Michigan. (Authors)

16341. Moshenko, Robert W., and John H. Gee (Dept. of Zool., Univ. of Manitoba, Winnipeg, Manitoba, Canada). 1973. DIET, TIME AND PLACE OF SPAWNING, AND ENVIRONMENTS OCCUPIED BY CREEK CHUB (Semotilus atromaculatus) IN THE MINK RIVER, MANITOBA. J. Fish. Res. Bd. Canada, 30(3): 357-362.

Creek chub (Semotilus atromaculatus) are omnivorous with a diet consisting of berries, insects, crayfish, noncyprinid fishes, and frogs. In 1971, in the Mink River, most spawning occurred between the middle and end of May in shallow (< 25 cm) fast-flowing (> 15 cm/sec) waters. Fecundity varied from 1146 to 7539 ova per female. In summer most chub in their 1st and 2nd years occupied moderately deep waters (<50 cm) with little current (0-30 cm/sec), while most older chub occupied deeper waters. In autumn chub were most abundant in deep (>50 cm) sheltered pools, where they overwintered. (Authors)

16342. Gordon, D., D. W. Chapman, and T. C. Bjornn (F. F. Slaney and Company, Ltd., Vancouver, British Columbia, Canada). 1973. ECONOMIC EVALUATION OF SPORT FISHERIES - WHAT DO THEY MEAN? Trans. Amer. Fish. Soc., 102(2): 293-311.

During 1968 we surveyed anglers in Idaho to assess: (1) gross annual expenditures by sport fishermen, (2) net value and consumer surplus of various high quality sport fishery resources in the state, and (3) distribution of fishing effort within Idaho by resident and nonresident anglers. Our objective in this paper is to: use the 1968 survey to review and evaluate techniques for assigning values to sport fisheries; compare our data with other surveys and plead for consistency in deriving economic values; and lastly, to ask "what should these values mean to resource decision makers?" Using transfer costs assessed by mail questionnaires, we simulated demand functions for eight fisheries in Idaho. These fisheries accounted for 45% of the days fished by anglers in 1968. The estimated net value was $4,700,000, consumer surplus was $9,435,000, and capitalized net worth (at 4 3/4% interest) was $100 million. Anglers spent about $21 million on all fishing in Idaho in 1968. We found considerable variance among several studies of expenditures and transfer or variable costs, even in the Pacific Northwest, and suggest that consistent estimating procedures could greatly improve comparability of studies. We noted that gross expenditures do not satisfactorily measure resource value, although they may indicate trends in demand. Estimates of net worth crudely approximate user-oriented worth of a fishery if the resource were owned and marketed by a monopolist (e.g., the state), while consumer surplus roughly measures the unpaid-for benefits now received by anglers under non-market conditions. Capitalized values may offer comparisons of resource worth in some situations. No measures are currently available for non-user fishery values, and until such measures are obtained, the benefits to society from fisheries will always be underestimated. Data on angler effort and expenditures, together with biological information can help administrators to optimize allocation of personnel and resources toward specific management objectives, and often assist the private sector. (Authors)

16343. Keefe, Carolyn W. (Chesapeake Biol. Lab., Nat. Res. Inst., Univ. of Maryland, Solomons, Maryland 20688). 1972. MARSH PRODUCTION: A SUMMARY OF THE LITERATURE. Contributions in Marine Science, Vol. 16, pp. 163-181.

A review has been made of studies of freshwater and saltwater marsh production. Reasons are discussed for the unusually high production of these communities when compared with terrestrial communities and phytoplankton. The role of marsh plants as food for consumers is also discussed. (Auth.)

16344. Clark, Stephen H. (Univ. of Miami, 10 Rickenbacker Causeway, Miami, Florida 33149). 1971. FACTORS AFFECTING THE DISTRIBUTION OF FISHES IN WHITEWATER BAY, EVERGLADES NATIONAL PARK, FLORIDA. Univ. of Miami Sea Grant Technical Bulletin No. 8, 100 p., 9 tables, 10 figs., price $3.00.

During the period from September 1968 to November 1969, a study of juvenile fish populations was conducted in Whitewater Bay, Florida. The objectives of this investigation were to study factors determining species distributions within the estuary and to assess the variation in the observed catch rates and the nature of the underlying data distributions. A total of 68 species representing 36 families and 14 orders were collected during this study. The bulk of the catch was accounted for by two species, Eucinostomus gula and Lagodon rhomboides, which contributed 34.9 and 27.7 percent of the total respectively. The 12 most abundant fishes contributed 94.6 percent of the total catch; these represented the families Batrachoididae, Syngnathidae, Lutjanidae, Gerridae, Pomadasyidae, Sparidae, Sciaenidae, Gobiidae, Soleidae, and Cynoglossidae. Data for 15 of the more common species were tested for agreement with the negative bionomial distribution. At low population densities, these usually approximated the Poisson series, but where contagion was evident the agreement was usually found to be good. Very infrequently, evidence was found that such data conformed to some other pattern; these cases were usually associated with bimodality, some degree of randomness, or skewness. The apparent tendency of species catch data to follow the negative bionomial has also been observed in earlier studies. However, the distribution of species per tow showed only partial agreement with the Poisson form of distribution, while the total data for all species did not conform to Fisher's logarithmic series in all cases tested; such results have not been observed by previous investigators. Tests of two transformations applicable to contagiously distributed data revealed Anscombe's logarithmic transform employing the negative bionomial statistic k to be more effective than Taylor's procedure in stabilizing the variance and reducing skewness. This transformation was used in all subsequent parametric analysis of variance tests. Catch data for 12 species were tested by factorial analysis of variance to determine the effects of nights (including tides), tow direction, and nets on the observed catch rates. Differences between nights, and some suggestion of interactions between nights and tow direction and nights and nets, appeared to exist for Eucinostomus gula and Gobiosoma robustum. For the study as a whole, however, the influence of the factors tested appeared to be negligible. Friedman's two way analysis of variance was used for comparisons of catch rates among stations. For all fishes tested, significant differences ($P \leq .05$) were observed; these could usually be attributed primarily to differences in vegetation density. A similar test for differences in mean number of species captured among stations was also significant ($P \leq .01$) and appeared to result both from vegetation differences and from increased richness of the fauna in higher salinity areas. Earlier investigators have shown that the distribution of juvenile fishes in estuaries may be affected by salinity-induced movements to more optimum areas with increased size. To determine if such movements could have influenced the areal differences observed in the present study, size frequency distributions were prepared for six of the more common species; these were examined for monthly differences among stations. A definite trend of increasing size proceeding towards higher salinity areas was observed for three of these fishes, indicating a seaward movement which appeared to be of importance in determining the late summer and early fall distributions of Eucinostomus gula and Lagodon rhomboides. For the study as a whole, however, the influence of this factor appears to have been minor compared with that of vegetation. Tests for seasonal changes in catch rates using Friedman's two-way analysis of variance were usually significant ($P \leq .05$). The differences observed appeared to result from population increases due to recruitment and later declines due to seasonal movement, mortality or other factors. There appeared to be little if any relation between seasonal catch rates and changes in environmental factors measured on the study area. (Auth. summ. and conclusions)

16345. Hughes, Janice S. (Editor, La. Wild Life & Fish. Comm., Baton Rouge, Louisiana 70804). 1972. CONTOUR MAPS OF MAJOR LAKES IN LOUISIANA. La. Wild Life & Fish. Comm. Fisheries Bull. No. 10, 30 lakes, illus.

16346. Marking, Leif L., and Charles R. Walker (Fish Control Lab., Fish and Wildl. Service, U.S. Dept. of the Interior, La Crosse, Wisconsin). 1973. THE USE OF FISH BIOASSAYS TO DETERMINE THE RATE OF DEACTIVATION OF PESTICIDES. Bioassay Techniques and Environmental Chemistry, Ann Arbor Science Publishers, Inc., pp. 357-366.

The biological half-life of a pesticide is the time required to decrease its toxicity by one-half. Half-lives can be established by determining the tolerance of fish or other organisms in bioassays of aged solutions containing unknown residual concentrations, and in concurrent reference tests containing known concentrations. The half-life of biological activity is calculated in two procedures by plotting (1) the percent concentration remaining in aged solutions or (2) the deactivation indices against aging time on cyclic semi-logarithmic graph paper. The half-life of biological activity of antimycin, a powerful fish toxicant, was determined for rainbow trout, goldfish, channel catfish, black bullhead, green sunfish, and bluegill. Antimycin was deactivated rapidly in high pH waters, and the half-lives were as follows: pH 10 = 1.5 hours, pH 9.5 = 4.6 hours, pH 9.0 = 9.7 hours, pH 8.5 = 46 hours, pH 8 = 100 hours, pH 7.5 = 120 hours, and pH's 6.0 and 6.5 = 310 hours. (Authors)

16347. Cairns, John, Jr., and Kenneth L. Dickson (Biol. Dept. and Center for Environ. Studies, Va. Polytechnic Inst. and State Univ., Blacksburg, Virginia). 1973. THE EFFECTS OF WASTE DISCHARGES FROM RADFORD ARMY AMMUNITION PLANT ON THE BIOTA OF THE NEW RIVER, VIRGINIA. VPI-WRRC-BULL. No. 57, 57 p.

The effects of waste discharges from Radford Army Ammunition Plant (RAAP), Radford, Virginia on fish, bottom fauna, algae, and higher aquatic plants in the New River were investigated in June 1971. Sampling stations were established upstream and downstream from the RAAP discharges. These stations were located to evaluate the individual effects of the various discharges (acid wastes, organic solvent wastes, thermal effluents, nitrogenous TNT wastes, and ash) on the fauna and flora. This was possible because there are a number of waste streams discharged at various points along the New River rather than a single combined waste discharge. An independent analysis of the data for each taxonomic group is presented along with general conclusions which integrate the findings of all the investigators. The waste discharges from the plant caused localized damage to the fauna and flora of the New River; however, the river had recovered in the five miles contained within the boundaries of the plant property. (Authors)

16348. Fimreite, Norvald, and Lincoln M. Reynolds (H. G. Acres Limited, Niagara Falls, Ontario Canada). 1973. MERCURY CONTAMINATION OF FISH IN NORTHWESTERN ONTARIO. J. Wildlife Mgmt, 37(1): 62-68.

Mercury levels were determined in lateral musculature of fish from Northwestern Ontario in specimens taken upstream and downstream from a chlorine plant, and from a number of lakes not contaminated from any known source. The maximum mercury levels in northern pike (Esox lucius), burbot (Lota lota), and walleye (Stizostedion vitreum) were 27.8, 24.8, and 19.6 ppm respectively, measured in specimens taken 50-60 miles downstream from the plant. They decreased proportionally to the distance from the plant but were clearly elevated even 200 miles downstream. The levels in specimens from suspected uncontaminated lakes were generally below 1 ppm but frequently above the 0.2 ppm often considered as the maximum background concentrations. The latter finding may possibly be explained on the basis of the oligotrophic conditions characteristic for these lakes. (Authors)

16349. European Inland Fisheries Advisory Commission (FAO, Rome, Italy). 1972. REPORT OF THE SYMPOSIUM ON THE MAJOR COMMUNICABLE FISH DISEASES IN EUROPE AND THEIR CONTROL. EIFAC Technical Paper No. 17, 40 p., edited by William A. Dill, Secretary.

16350. Kroger, Richard L., and Robert L. Dryfoos (NMFS, Atlantic Estuarine Fisheries Center, Beaufort, North Carolina 28516). 1972. TAGGING AND TAG-RECOVERY EXPERIMENTS WITH ATLANTIC MENHADEN, Brevoortia tyrannus. NOAA Technical Report NMFS SSRF-664, 11 p.

Laboratory tagging experiments with adult and juvenile Atlantic menhaden were conducted at Beaufort, N. C., in 1965 and 1969. Tag-recovery experiments were done at menhaden processing plants at Beaufort, N. C. Internal ferromagnetic body tags of appropriate sizes are suitable for tagging adults and juveniles, and the tags can be recovered effectively on magnets in the processing plants. (Authors)

16351. Nelson, Gareth, and M. Norma Rothman (Dept. of Ichthyology, The Amer. Museum of Natural History, New York). 1973. THE SPECIES OF GIZZARD SHADS (DOROSOMATINAE) WITH PARTICULAR REFERENCE TO THE INDO-PACIFIC REGION. Bull. of the American Museum of Natural History, Vol. 150, article 2, pp. 131-206, figs. 1-13, tables 1-5, maps 1-4, price $3.20.

The Indo-Pacific fishes commonly called gizzard shads include two tribes (the Anodontostomatini and Clupanodontini) and at least 12 species (Anodontostoma chacunda, Gonialosa manmina, G. modesta, Nematalosa arabica, N. come, N. erebi, N. galatheae, new species, N. japonica, N. nasus, N. vlaminghi, new combination, Clupanodon punctatus and C. thrissa). These species are generally better defined and more easily recognized by nonmeristic characters than by counts of scales, fin rays, vertebrae, ventral scutes, and predorsal bones. The North American gizzard shads include one tribe (Dorosomatini) and, as currently recognized, five species (Dorosoma anale, D. cepedianum, D. chavesi, D. smithi, and D. (Signalosa) petenense), defined primarily on the basis of meristic characters. This paper reviews the taxonomy of the Indo-Pacific species and provides a key for their identification, an account of their variation and distribution, and an analysis of their scientific literature. For North American species, references to recent literature are included. The gut of the gizzard shads differs from that of other clupeoids in having a third primary flexure. The tribes recognized are based partly on the variations of the third flexure. (Authors)

16352. MacLeod, J. C., and E. Pessah (Dept. of the Environ., Fish. Res. Bd. of Canada, Freshwater Inst., Winnipeg, Manitoba, Canada). 1973. TEMPERATURE EFFECTS ON MERCURY ACCUMULATION, TOXICITY, AND METABOLIC RATE IN RAINBOW TROUT (Salmo gairdneri). J. Fish. Res. Bd. Canada, 30(4): 485-492.

Mercury toxicity in rainbow trout fingerlings was related to temperature and chemical formulation of the mercury. At 10 C, the 24-hr TL_m concentration (median tolerance limit) for mercuric chloride ($HgCl_2$) was approximately 30 times that for phenyl mercuric acetate (PMA). The 96-hr TL_m values for mercuric chloride at 5, 10, and 20 C were 0.40, 0.28, and 0.22 mg Hg/liter. The velocity of mortality, (V = reciprocal of time to death in hours), was linearly related to temperature. For a mercuric chloride concentration of 0.5 mg Hg/liter, V = .002 + .0023t, where t = temperature in centigrade degrees. Temperature also affected accumulation rate of mercury in the fish muscle. At 5, 10, and 20 C a mercuric chloride concentration of 0.1 mg Hg/liter in the water produced biological magnification factors (conc. in fish ÷ conc. in water) of 4, 10, and 22X, respectively. PMA produced higher magnification factors of 80-100X at 10 C. Active metabolic rate, though increased by higher temperatures, was depressed by mercuric chloride, and higher temperatures augmented the depressant effect. (Authors)

16353. Salli, Arne J. (Lab. of Limnology, Dept. of Zool., Univ. of Wisconsin, Madison, Wisconsin 53706). 1973. A PORTABLE OBSERVATION CHAMBER FOR THE STUDY OF FISH BEHAVIOR. Trans. Amer. Fish. Soc., 102(2): 456-459.

A portable observation chamber used in the study of fish behavior in the natural environment is described. The chamber, containing two observation windows, is constructed of marine plywood attached to a supporting framework. Adjustable pipe legs permitted observation at various heights either above water or under water. (Auth.)

16354. Carrithers, Ralph B., and Frank J. Bulow (Tenn. Tech. Univ., Cookeville, Tennessee 38501). 1973. AN ECOLOGICAL SURVEY OF THE WEST FORK OF THE OBEY RIVER, TENNESSEE WITH EMPHASIS ON THE EFFECTS OF ACID MINE DRAINAGE. J. Tenn. Acad. Sci., 48(2): 65-72.

A one-year study of the West Fork of the Obey River in Overton County, Tennessee, was undertaken to survey the water quality, benthic macroinvertebrate population, and fish population. A secondary objective was to determine the effects of acid mine drainage from a small intermittent tributary stream, Cub Creek. Water quality immediately below the zone of pollution was only slightly affected. A precipitate resulting from the reaction of sulfuric acid and iron salts with carbonates covered the bottom below the source of pollution, thereby reducing the total numbers and taxonomic diversity of the benthic macroinvertebrate and fish populations. Cub Creek had a localized, detrimental effect on the water quality, benthos, and fish populations in the West Fork. Thirteen water quality parameters were monitored. Twenty-five invertebrate families and 29 species of fishes were identified. (Authors)

16355. Chenoweth, Stanley B. (Northeast Fish. Center, NMFS, NOAA, West Boothbay Harbor, Maine 04575). 1973. FISH LARVAE OF THE ESTUARIES AND COAST OF CENTRAL MAINE. NOAA Fishery Bulletin, 71(1):105-113.

Seasonal sampling of fish larvae in the central Maine coast took 22 kinds of larvae; 17 were identified to species, 3 to family, and 2 were not identified. Larvae of a few highly abundant species were present in the winter and early spring. These hatched from demersal eggs and were concentrated in the upper estuaries. The remaining species were less abundant and were present during the spring and summer. Most of these larvae hatched from pelagic eggs and were not greatly concentrated in the upper estuaries. The larvae of only one commercially important species, Clupea harengus harengus, were found abundantly in the region. (Auth.)

16356. Gardner, George R., and Gilles LaRoche (U.S. Environ. Protection Agency, NMWQ Lab., West Kingston, R. I. 02892). 1973. COPPER INDUCED LESIONS IN ESTUARINE TELEOSTS. J. Fish. Res. Bd. Canada, 30(3): 363-368.

Cellular changes attributable to copper were observed in the mechanoreceptors of the lateral line canals in the head of adult mummichog (Fundulus heteroclitus) and Atlantic silverside (Menidia menidia). The epithelium of these canals was also altered in F. heteroclitus. In both species, lesions were observed in the olfactory organs, which included the chemoreceptive sites. These manifestations of copper poisoning were evident at all studied concentrations (0.5, 1.0, and 5.0 mg/liter) of the metal. In M. menidia dilation of blood vessels was apparent, and in five cases hemorrhage had occurred in the brain and in periorbital connective tissues. Renal lesions in F. heteroclitus exposed to 1.0 and 5.0 mg/liter of copper were apparent; these changes could not be identified in M. menidia. Hepatic changes were not detectable by light microscopy in either species following external exposures to copper. High concentrations of copper administered intraperitoneally to F. heteroclitus did induce liver damage. Fry of F. heteroclitus were more sensitive to copper than were the adults or their zygotes. The emergence of larval forms from the zygote, the time required for emergence, and their survival was impaired by the metal. Lesions were not evident in developing sensory areas of the lateral line or the olfactory systems in these immature forms. (Authors)

16357. Jackson, D. A., and D. R. Gardner (Dept. of Biol., Carleton Univ., Ottawa, Ontario, Canada). 1973. THE EFFECTS OF SOME ORGANOCHLORINE PESTICIDE ANALOGS ON SALMONID BRAIN ATPases. Pesticide Biochemistry and Physiology, 2(4): 377-382.

The effects of various organochlorine pesticides on salmon and trout brain ATPases were investigated. Organochlorines reduced the enzyme activity to various degrees, but only at concentrations which exceeded their solubility limits. When organochlorine precipitation was prevented by introduction of a surfactant, the reduction in enzyme activity was usually abolished. (Authors)

16358. Eisler, Ronald, and George R. Gardner (U.S. Environ. Protection Agency, Nat'l Mar. Water Qual. Lab., West Kingston, R.I. 02892). 1973. ACUTE TOXICOLOGY TO AN ESTUARINE TELEOST OF MIXTURES OF CADMIUM, COPPER AND ZINC SALTS. J. Fish Biol., 5(2): 131-142.

Effects of mixtures of chloride salts of cadmium, copper and zinc on survival, whole body residues, and histopathology of mummichog, Fundulus heteroclitus (L.), were investigated in synthetic seawater at 20 °/oo salinity and 20°C. Mixtures of Cu^{2+} and Zn^{2+} as indicated by 96 h bioassay studies produced more deaths than expected on the basis of toxicities of individual components. Concentrations of Cd^{2+} not ordinarily lethal exerted a negative effect on survival of fish intoxicated by salts of copper, zinc, or both. Atomic absorption determinations of Cd, Cu, and Zn residues in mummichog which survived 96 h exposures to each of these toxicants provided useful indices of total body burdens for these metals. Residues from survivors held in mixtures, especially Cd^{2+} and Zn^{2+} mixtures, did not conform to patterns observed for single elements. Whole body aggregates of Cd, Cu, and Zn from dead mummichogs were of limited worth owing to possible accumulation of these metals from the medium after death. Renal and lateral line canal lesions were noted in all fish subjected to copper concentrations of 1 mg/l and higher. Renal lesions observed in fish immersed in mixtures of Cu^{2+} and Cd^{2+} assumed a damage pattern characteristic of Cd^{2+}; with mixtures of Cu^{2+} and Zn^{2+}, lesions were typical of Cu^{2+}-induced damage. Lesions induced in lateral line epithelium by Cu^{2+} were not affected by either Cd^{2+} or Zn^{2+}. Epithelia lining the oral cavity were necrotized by the caustic action of high levels of Zn^{2+} (60 mg/l) and of Cu^{2+} (8 mg/l). (Authors)

16359. Lovell, Richard T. (Dept. of Fisheries and Allied Aquaculture, Auburn Univ., Auburn, Alabama 36830). 1973. ESSENTIALITY OF VITAMIN C IN FEEDS FOR INTENSIVELY FED CAGED CHANNEL CATFISH. Journal of Nutrition, 103(1): 134-138; NOAA Marine Fisheries Abstracts, 26(5): p. 24.

Sixteen hundred channel catfish fingerlings were stocked in 1-m^3 floating cages, 400 per cage, and fed production-type diets intensively for 180 days. Half of the fish were fed a diet that was nutritionally sufficient except for being low in vitamin C and the remaining fish were fed the same formulation with supplemental vitamin C. At the end of the feeding period each fish was examined for gross signs of vitamin C deficiency and fish were sampled for examination for internal symptoms by X-ray, tissue analysis, and histological techniques. Weight gains (g), feed conversions (g gain/g feed), survival (%) and incidence of physical deformation (%) for fish fed diets with and without supplemental ascorbic acid, respectively, were 531 vs. 331; 1.29 vs. 1.88; 98.0 vs. 77.8; and 3.9 vs. 45.0. Deformities were primarily scoliosis and lordosis with depigmented areas on backs. Vitamin C deficiency resulted in higher mortality from pathogenic bacteria infestation. Differences in response to the two diets did not become apparent until after the fish had grown satisfactorily for at least 12 weeks or weighed 100 to 180 g. Dietary supplementation of vitamin C was reflected in blood, liver and anterior kidney contents of ascorbic acid but not in condition of gill filaments or opercula. (Auth.)

16360. Overstreet, Robin M. (Gulf Coast Res. Lab., Ocean Springs, Mississippi). 1973. SOME SPECIES OF Lecithaster Lühe, 1901 (DIGENEA: HEMIURIDAE) AND RELATED GENERA FROM FISHES IN THE NORTHERN GULF OF MEXICO. Trans. Amer. Microscopical Soc., 92(2): 231-240.

Lecithaster helodes n. sp. is described from Mugil curema and M. cephalus. It differs from the closely related L. mugilis Yamaguti, 1970 by having four rather than three ovarian lobes and other minor differences. Discussions and measurements are presented for L. confusus Odhner, 1905, L. leiostomi Overstreet, 1970, Hysterolecitha elongata Manter, 1931, Aponurus pyriformis (Linton, 1910) n. comb., and A. elongatus Siddiqi and Cable, 1960. Branchadena Linton, 1910 is considered a synonym of Aponurus Looss, 1907. New host records are listed for some of the above hemiurid trematodes. Leurodera ocyri Travassos, Freitas and Bührnheim, 1965 and L. inaequalis Travassos, Freitas and Bührnheim, 1965 are considered synonyms of A. pyriformis. (Auth.)

16361. Manion, P. J., and A. L. McLain (Bur. of Comm. Fisheries, Marquette, Michigan). 1971. BIOLOGY OF LARVAL SEA LAMPREYS (Petromyzon marinus) OF THE 1960 YEAR CLASS, ISOLATED IN THE BIG GARLIC RIVER, MICHIGAN, 1960-1965. Great Lakes Fish Comm Tech Rep. 16, pp. 1-35, illus.; Selected Water Resources Abstracts, 6(9): p. 11, 1973.

The early life history of the sea lamprey, from hatching to the first capture of metamorphosed individuals, is described from observations on a known-age population isolated in a tributary of southern Lake Superior. The population had its origin in the spring of 1960, when 722 sea lampreys nearing spawning condition were introduced into the Big Garlic River, Marquette County, Michigan, a stream that had previously been free of lampreys because physical barriers prevented their upstream migration. The adults constructed 206 nests and spawned in 161 of them; an estimated 774,000 larvae were hatched. The average total lengths of larvae collected in Oct. (when yearly growth was nearly complete) in 1960-65 were 13, 39, 63, 80, 92, and 107 mm in the successive years. A specially designed inclined-plane trap, installed at the lower end of the study area to monitor the downstream movement of larval and newly metamorphosed lampreys captured 7562 larvae in 1962-65 (none in 1960-61). The annual catch increased sharply from 9 in 1962 to 370 in 1963, 2847 in 1964, and 4336 in 1965. About 90% of each annual catch was taken by June 30. Most movement was at night. A total of 5642 larvae were marked in 1962-65 by the subcutaneous injection of an insoluble dye, to study movement and distribution; 222 were recovered as larvae through 1965 (17 in the trap and 205 with an electric shocker). The recoveries of marked lampreys, the increase in density of larvae in the farthest downstream section of the study area, and the annual catches in the trap demonstrated that a large part of the population gradually shifted downstream. Many larvae were still within less than 1 km from the place of hatching, after more than 5 yr. The capture of 4 recently metamorphosed sea lampreys (2 males and 2 females), 152-172 mm long, in the fall of 1965, established the minimum age at transformation for larvae in the Big Garlic River at 5 yr. Age and length (with the exception of a possible minimum length) were determined not to be critical factors in metamorphosis. The presence of larvae 65-176 mm long (mean, 107 mm) in the river in 1965 indicated that metamorphosis of lampreys of a single year class takes place over a period of years. -- Biological Abstracts, Inc.

16362. Shorey, Wayne K. (Dept. of Zool., Univ. of Maine, Orono, Maine). 1973. MACROBENTHIC ECOLOGY OF A SAWDUST-BEARING SUBSTRATE IN THE PENOBSCOT RIVER ESTUARY (MAINE). J. Fish. Res. Bd. Canada, 30(4): 493-497.

The macrobenthos of sawdust-bearing substrates in the Penobscot River estuary (Maine) were sampled bimonthly from January through November 1968. The polychaete Scolecolepides viridis and the bivalves Macoma balthica and Mya arenaria dominated the sandy sediments of the shallow station. Prionospio malmgreni and Corophium volutator were dominant in the granular substrate of the deeper station. The population of the shallow station (1-m depth, mean low water) was seasonally more stable and had a higher mean monthly bio-index (number of individuals/number of species) than that of the deeper station (6-m depth, mean low water). (Auth.)

16363. Adams, B. L., W. S. Zaugg, and L. R. McLain (Western Fish Nutrition Lab., Bur. Sport Fish. & Wildl., Cook, Washington 98605). 1973. TEMPERATURE EFFECT ON PARR-SMOLT TRANSFORMATION IN STEELHEAD TROUT (Salmo gairdneri) AS MEASURED BY GILL SODIUM-POTASSIUM STIMULATED ADENOSINE TRIPHOSPHATASE. Comp. Biochem. Physiol., Vol. 44A, pp. 1333-1339.

The effect of temperature (6.5, 10, 15 or 20°C) on the increase of gill microsomal Na^+-, K^+-stimulated ATPase activity associated with parr-smolt transformation in steelhead trout (Salmo gairdneri) was found to be crucial. At 6.5 or 10°C there was a twofold increase in Na^+-, K^+-ATPase and a sharp decrease in coefficient of condition at the beginning of the smolt season in March. In June the

ATPase activity returned to pre-smolt level and the coefficient of condition increased to or above that of the parr. At 15 or 20°C there was no increase in Na^+-, K^+-ATPase nor did the coefficient of condition decrease during the smolt season. Preliminary tests showed a correlation of salt water survival with high Na^+-, K^+-ATPase activity. These results indicate that in steelhead trout parr-smolt transformation and subsequent sea water adaptation are inhibited by water temperatures of 15 and 20°C. (Authors)

16364. Netsch, Norval F., Garland M. Kersh, Jr., Alfred Houser, and Raj V. Kilambi (So. Central Reservoir Investigations, Bur. Sport Fish. & Wildl., Fayetteville, Arkansas). 1971. DISTRIBUTION OF YOUNG GIZZARD AND THREADFIN SHAD IN BEAVER RESERVOIR. Reprint from Reservoir Fisheries and Limnology, Spec. Publ. No. 8 of the Amer. Fish. Soc., pp. 95-105.

Young gizzard and threadfin shad were sampled systematically with meter nets and midwater trawls for a 2-year period in 11,420-hectare Beaver Reservoir, Arkansas. The pattern of seasonal abundance of both species was an initial rapid build-up of the population which reached a peak density 4 to 8 weeks after spawning began, with a rapid decrease in numbers thereafter. Highest densities were usually found in the up-reservoir areas. Nighttime catch rates were 5-110 times greater than daytime rates, but the relative vertical distribution patterns were generally similar in the same area regardless of time of day. Mean lengths of shad were greater in nighttime catches. Vertical distribution patterns differed by area of reservoir. The greatest relative densities of young shad in the upper end of the reservoir were at the surface, both on and off shore. In the less turbid lower end of the reservoir, the greatest densities were found at a depth of 5 meters. The larger sizes of threadfin shad were seldom found in samples taken at 10 and 15 m. No consistent size differences by depths were found for the gizzard shad. In June 1968, there were significant differences in numbers of gizzard shad by depths and in numbers of threadfin shad by depths and areas. Analysis of variance of one midreservoir area in 1969 by individual weeks indicated significant differences in numbers of gizzard shad by locations for 2 of 11 weeks and by depths for 9 of 11 weeks. There were also significant differences in threadfin shad by locations for 2 of 8 weeks and by depths for 3 of 8 weeks. (Authors)

16365. Sandifer, Paul A. (So. Carolina Marine Res. Lab., 217 Ft. Johnson Road, P. O. Box 12559, Charleston, So. Carolina 29412). 1973. EFFECTS OF TEMPERATURE AND SALINITY ON LARVAL DEVELOPMENT OF GRASS SHRIMP, Palaemonetes vulgaris (DECAPODA, CARIDEA). NOAA Fishery Bull., 71(1): 115-123.

Larvae of Palaemonetes vulgaris were reared in the laboratory in a factorial experiment employing three temperatures (20°, 25°, and 30°C) and six salinities (5, 10, 15, 20, 25, and 30 °/oo). Temperature and salinity exerted significant effects at the 1% level on survival of larvae through metamorphosis. The temperature-salinity interaction was also significant, but at the 5% level. Lowest survival occurred in 5 °/oo at all temperatures. In higher salinities, survival at 20° and 25°C was similar ($>$ 60%) but was significantly less at 30°C in most salinities. Temperature and salinity also influenced the rate of larval development. Development at 20°C required nearly twice the time as that at 25° and 30°C, but a retarding influence of salinity was slight and evident only at low salinities (5 and 10 °/oo). Considerable variation in the number of larval instars was observed among animals which survived to the postlarval stage. Metamorphosis occurred as early as the fifth molt and as late as the twelfth. Salinity and temperature-salinity interaction had no detectable influence on the number of instars, but the effect of temperature was significant at the 1% level. Larvae reared at 25°C passed through fewer molts prior to metamorphosis than did those reared at 20° and 30°C. Comparing survival, rate of development and number of instars, optimal conditions for larval development occurred at a moderate temperature of about 25°C over a wide range of salinity (10 to 30 °/oo). (Auth.)

16366. Zenro, Minami, Masanao Kajita, and Susumu Hibino (Nagase and Co., Ltd., Amagasaki, Japan). 1972. STUDIES ON THE UTILIZATION OF PETRO-YEAST AS DIET OF FRESHWATER FISH--I. THE DISTRIBUTION OF CHITIN DECOMPOSING BACTERIA IN DIGESTIVE TRACTS. Bull. Jap. Soc. Sci. Fish., 38(9): 1013-1019; NOAA Marine Fisheries Abstracts, 26(4): p. 19.

Yeast derived from metabolizing petroleum (petro-yeast) are characteristically high in chitin content. The ayu (Plecoglossus altivelis), carp (Cyprinus carpio), and rainbow trout (Salmo gairdneri) use petro-yeast in their feed with high efficiency. To elucidate such efficient utilization of petro-yeast by these fish, the distribution of chitin decomposing bacteria in their digestive tracts was examined. Chitin decomposing bacteria were isolated in relatively high frequency. The proportion of chitin decomposing bacteria to total bacteria in the digestive tract was high in each species of fish. According to biochemical characteristics, most of the chitin decomposing bacteria in the digestive tracts of marine fish were mainly under the genus Vibrio. In further studies of utilization of feed, carp was determined to use petro-yeast most efficiently. The authors attribute the utilization efficiency to a high incidence of chitin decomposing bacteria in the digestive tract of the carp.

16367. Nelson, D. M., G. P. Romberg, and W. Prepejchal (Argonne National Lab., Illinois). 1971. RADIONUCLIDES IN LAKE MICHIGAN FISH. In: Report ANL-7860 (Pt. 3), Radiological Physics Div. Ann. Report, Jan.-Dec. 1971, pp. 141-150; Selected Water Resources Abstracts, 6(7): p. 44.

In order to provide baseline data needed to evaluate any additional radioactive releases, fish samples were collected from Lake Michigan during 1970-1971 and analyzed for gamma ray emitting radionuclides. The Cs137 content of certain fish (those with limited range) near the Big Rock Nuclear Reactor (a 70-MW boiling water reactor completed in 1962) was about double that near the Point Beach Nuclear Reactor (a 480-MW pressurized water reactor completed in 1970). The Cs137/Cs137 ratio was not high enough to support a recent station contribution of greater than 20% to the total Cs137 concentration, except in a small number of bass and trout samples; however Zn65 was detected, which is more straightforwardly attributable to the Big Rock station. A diet of 100 grams/day of fish with the highest radioactivity of those caught would contribute 0.3% of the maximum recommended daily intake.

16368. Houser, Alfred, and Norval F. Netsch (So. Central Reservoir Investigations, Bur. Sport Fish. & Wildl., Fayetteville, Arkansas). 1971. ESTIMATES OF YOUNG-OF-YEAR SHAD PRODUCTION IN BEAVER RESERVOIR. Reprint from Reservoir Fisheries and Limnology, Spec. Publ. No. 8 of the Amer. Fish. Soc., pp. 359-370.

Studies of the population dynamics of threadfin and gizzard shad were conducted by South Central Reservoir Investigations from 1965 through 1970. A method for estimating the sizes of juvenile shad populations developed in 1965 has been used each summer in Beaver Reservoir, Arkansas. Catch rates of larvae and juveniles in 1-meter townets obtained in 1968, 1969, and 1970 were used in conjunction with midwater trawl results to construct models of populations of threadfin and gizzard shad from hatching in the spring through autumn. Estimates of population size, biomass, and production for both species were made. The effects of avoidance on meter net catches and of escapement when using a trawl with larger meshes were demonstrated. Production estimates in 1968 and 1969 were considered unreliable because of these errors. More reliable sampling in 1970 yielded a gizzard shad production estimate of 45 kg/ha. Threadfin shad failed to produce a normal year class, but 1970 production was estimated to be $>$ 11.7 kg/ha. (Authors)

16369. Mayes, Monte A. (Dept. of Zool., North Carolina State University, Raleigh, North Carolina). 1973. MONOGENETIC TREMATODES FROM THE BLUESPOT SUNFISH Enneacanthus gloriosus (Holbrook) IN NORTH CAROLINA. Trans. Amer. Microscopical Soc., 92(2): 280-284.

16370. Pyle, A. Bruce, and Robert H. Soldwedel (N. J. Dept. of Environ. Protection, Div. of Fish, Game and Shellfisheries, Freshwater Fish. Lab., Lebanon, New Jersey). 1973. INVESTIGATIONS IN THE MORTALITY OF STOCKED TROUT IN NEW JERSEY STREAMS. N. J. Dept. of Environ. Protection Misc. Report No. 36, 28 p.

Out of the eighteen streams employed in this study six were found to be unsuitable for stocking with hatchery-reared trout until their temperatures increased to about 42°F. after April 1st. These six streams are located in Central New Jersey and their chemical characteristics are considered to be largely responsible for the inability of brook, brown and rainbow trout from New Jersey's hatchery in Hackettstown to adjust and survive when stocked at colder temperatures. Toxicity is discounted as a factor because their waters maintain resident trout populations throughout the year. Sulfate and aluminum concentration increases are associated with the colder water temperatures but they alone are not considered adequate to recognize other streams posing similar trout adjustment problems. Therefore, the "fingerprinting" of streams is suggested as an aid in dealing with this problem. Mortality of the newly stocked trout is quite rapid, usually being complete in less than a week, with the order of decreasing susceptibility being rainbow trout, brown trout and brook trout. (Authors)

16371. Fischer, Hartwig, and Reino S. Freeman (Depts. of Parasitology and Zool., Univ. of Toronto, Toronto, Ontario, Canada). 1973. THE ROLE OF PLEROCERCOIDS IN THE BIOLOGY OF Proteocephalus ambloplitis (CESTODA) MATURING IN SMALLMOUTH BASS. Canad. J. Zool., 51(2): 133-141.

Plerocercoids of Proteocephalus ambloplitis removed from parenteral sites and the enteron of smallmouth bass, or parenteral sites in other fish from Lake Opeongo, were fed to bass which were either laboratory-reared or captured from the lake and treated with the anthelmintic di-n-butyl tin oxide. The experiments demonstrate that, following growth to plerocercoid I in copepods, plerocercoid II passes through three physiologically distinct levels of development in fish. "Initial" growth may be parenteral in bass or other fish; "middle" growth can be completed only while parenteral in bass; "terminal" growth of plerocercoid II precedes sexual maturation in the gut lumen of bass. Plerocercoids commonly enter the gut of bass by direct entry from parenteral sites in the same fish, and only rarely following ingestion of an infected bass, since cannibalism is rare in Lake Opeongo. Plerocercoids from parenteral sites in fish other than bass are, therefore, an essential reservoir, and most "middle" plerocercoid II in bass develop from "initial" plerocercoid II from parenteral sites in other species of infected fish that bass ingest. (Authors)

16372. Haaker, Peter L., and E. David Lane (Calif. Dept. of Fish and Game, Long Beach, California). 1973. FREQUENCIES OF ANOMALIES IN A BOTHID, Paralichthys californicus, AND A PLEURONECTID, Hypsopsetta guttulata, FLATFISH. Copeia No. 1, pp. 22-25.

Occurrence of abnormal coloration, hooking or cranial depression optic decussation and liver side reversal are reported for Paralichthys californicus (Bothidae) and Hypsopsetta guttulata (Pleuronectidae). California halibut possessed anomaly frequencies of 1.6 to 20.8 per thousand while diamond turbot had approximately half this frequency (1.2 to 9.5 per thousand). (Authors)

16373. Tong, S. C., Walter H. Gutenmann, Donald J. Lisk, George E. Burdick, and Earl J. Harris (N. Y. State Dept. of Environ. Conservation). 1972. TRACE METALS IN NEW YORK STATE FISH. New York Fish and Game Journal, 19(2): 123-131.

An analytical survey was conducted of the concentrations of eight metals in fish from 11 New York State waters. Analysis of barium, cadmium, cobalt, nickel, silver, tin, vanadium and zinc in fish was performed by spark source mass spectrometry following dry ashing of samples. Barium, cadmium and silver were present in the range of 0.1 ppm. Tin and zinc were usually found at relatively higher levels of 0.5 to several ppm. Cobalt, nickel and vanadium were intermediate in concentration being most often less than 1 ppm. (Authors)

16374. Krykhtin, M. L. (Lab. of Freshwater Fishes, Amur Div., Pacific Res. Inst. for Sea Fish. and Oceanog. (TINRO), Khabarovsk, USSR). 1972. CHANGES IN THE COMPOSITION AND ABUNDANCE OF STOCKS OF THE GREAT RUSSIAN STURGEON OR KALUGA [Huso dauricus (Georgi)] AND OF THE AMUR STURGEON [Acipenser schrencki (Brandt)] DURING THE PERIOD OF A FISHERY BAN IN THE AMUR BASIN. J. Ichthyology, 12(1): 1-9.

Changes in the abundance and structure of stocks of kaluga and Amur sturgeon in the delta region and in the Lower and Middle Amur are considered during the period when fishing was banned (1958-1970). An increase in the abundance and in the age of kaluga stocks was noted in the delta. The causes of the reduction in the numbers of sturgeons in some parts of the Amur Basin are shown and a number of recommendations made for the restoration of its stocks.

16375. Sanders, Herman O., Foster L. Mayer, Jr., and David F. Walsh (Fish-Pesticide Res. Lab., Bur. Sport Fish. & Wildl., Columbia, Missouri 65201). 1973. TOXICITY, RESIDUE DYNAMICS, AND REPRODUCTIVE EFFECTS OF PHTHALATE ESTERS IN AQUATIC INVERTEBRATES. Environmental Research 6(1): 84-90.

Aquatic invertebrates were exposed to di-n-butyl and di-2-ethylhexyl phthalate esters in water to determine toxicity, accumulation, and reproductive effects of these compounds. The acute toxicities were low and ranged from 2.1 mg/liter to greater than 32 mg/liter. Residue accumulation was rapid resulting in body residues 70-13,600 times that of the water concentration. Phthalate residues were essentially gone after 10 days in fresh water. A reproductive impairment of 60% occurred in Daphnia magna exposed continuously to 3 μg/liter of di-2-ethylhexyl phthalate. (Authors)

16376. Canadian Committee on Fish Diseases, Fisheries Research Board of Canada. 1972. CONSIDERATION AND RECOMMENDATIONS FOR THE CONTROL OF FISH DISEASES IN CANADA. Misc. Spl. Publ. No. 16, Fish. Res. Bd. of Canada, 52 p., mimeo; Fish Health News, 2(2): p. 2, 1973.

This report points out the urgent need to prevent the introduction and control the spread of diseases of fishes within Canada, and proposes for the first time, a national fish disease control programme. Background information includes: an inventory of diagnosed fish disease distribution in Canada; a review of present Federal and Provincial regulations that relate to fish diseases, and an assessment of present and future levels of intraprovincial and international traffic in live fish, eggs, and products from fish farms. Arguments are presented to show that the future of Canada's growing aquaculture industry, its recreational fisheries, and to an extent its commercial fisheries, depend upon the existence and development of healthy fish-cultural operations. These operations depend in turn upon the establishment of an effective Federal disease control programme. A series of recommendations, with some alternatives is elaborated which, in the Committee's opinion, would lead to the establishment of such a programme or system.

16377. Baker, Claude D., and Eugene H. Schmitz (Dept. of Zool., Univ. of Arkansas, Fayetteville, Arkansas). 1971. FOOD HABITS OF ADULT GIZZARD AND THREADFIN SHAD IN TWO OZARK RESERVOIRS. Reprint from Reservoir Fisheries and Limnology, Spec. Publ. No. 8 of the Amer. Fish. Soc., pp. 3-11.

The food habits of 620 gizzard shad and 386 threadfin shad were studied from May 1965 to August 1967 in newly impounded Beaver Reservoir and in older Bull Shoals Reservoir, Arkansas. Specimens were taken by trawling the limnetic areas and by electroshocking the littoral areas. Sucrose density-gradient centrifugation was used for separating detritus from identifiable organisms. Gizzard shad foreguts contained primarily detritus, whereas threadfin shad foreguts contained identifiable organisms. Relative quantities of organic detritus present in gizzard shad foregut contents varied between reservoirs and within reservoirs on a seasonal basis. In both reservoirs, both species ingested essentially the same organisms, predominantly diatoms and green algae. Organic detritus was a major food item of the gizzard shad and under some conditions may represent a significant addendum to the diet of the threadfin shad. Competition for food may occur in the older reservoir. (Authors)

16378. Sumari, Olli, and Kai Westman (Finnish Game and Fish. Res. Inst., Laukaa Fish Culture Res. Sta., 41360 Valkola, Finland). 1972. COMPARATIVE FEEDING EXPERIMENT ON RAINBOW TROUT (Salmo gairdneri) DESIGNED TO TEST AN AUTOMATIC SELF-FEEDER. Finnish Fish. Res. 1: 1-9.

An automatic self-feeder developed by B. Thuring in West Germany is described and its suitability for feeding yearling rainbow trout is tested. In a 146-day experiment the gain in weight was 469.4% for the fish fed with the self-feeder and 435.1% for the fish fed by hand three times daily. No marked difference was found between the two fish groups in the weight gains, weight frequency distribution, mortality, coefficient of condition or the haematocrit values. The self-feeder proved suitable for feeding second summer rainbow trout in 4 m^2 tanks. The utilization of the self-feeder in fish farming is discussed. (Authors)

16379. Hochachka, P. W., and B. Clayton-Hochachka (Oceanic Inst., Waimanalo, Hawaii). 1973. GLUCOSE-6-PHOSPHATE DEHYDROGENASE AND THERMAL ACCLIMATION IN THE MULLET FISH. Marine Biology, 18(4): 251-259.

Glucose-6-phosphate dehydrogenase in mullet liver (Mugil cephalus L.) occurs in 2 electrophoretically distinguishable forms, termed I and II. Both are tetramers (at neutral pH) with molecular weights greater than 200,000. At pH 9, each tetramer dissociates into two dimer molecules which retain catalytic activity. At intermediate pH values, an equilibrium tetramer —— dimer mixture probably occurs. Kinetic studies of Form I indicate that it is strongly inhibited by TPNH, which is competitive with respect to both G6P and TPN. Inhibition is greatly increased at high temperatures while enzyme-substrate and enzyme-coenzyme affinities greatly decrease. These properties strongly favor glucose-6-phosphate dehydrogenase function at low temperature, a situation that is partly compensated for during warm acclimation by an increase in the relative importance of Form II. Although Form II displays catalytic and regulatory properties which are qualitatively similar to those of Form I, it is able to outcompete Form I for limiting substrate at high temperatures. (Authors)

16380. Sedlar, J. 1970. AGE AND GROWTH OF THE GRAYLING Thymallus thymallus L. IN THE DRAINAGE AREA OF THE RIVER NITRA. (Vek a rast lipna obycajneho Thymallus thymallus L. v povodi rieky Nitry.). Biologia Brat., 25, no. 11, pp. 821-829; Agricultural Literature of Czechoslovakia, 3-4, No. 806, p. 174, 1971.

The age and growth of the grayling was estimated in 252 specimens obtained from the various flows of the Nitra river basin. The establishing of the populations differed in the different localities, but in all cases there was a characteristic and comparatively small proportion of older age categories. The oldest graylings were 6 years old and their body length ranged within 365 and 380 mm. In the total average the growth of the grayling was profitable only up to the 3rd or 4th year. As regards the structure of the populations the grayling is a polycyclic species. With regard to the short life of the grayling and to the unbalanced composition of populations connected with this, it is recommended, according to the mentioned results, to decrease its fishing length in the examined river basin from 30 to 26 cm.

16381. Bams, Robert A. (Fish. Res. Bd. of Canada, Pacific Biol. Sta., Nanaimo, British Columbia, Canada). 1973. EVALUATION OF GRAVEL INCUBATORS ON FIRST "HATCHERY" GENERATION TSOLUM RIVER PINK SALMON, 1970-72 PART I: EVALUATION AT THE FRY STAGE. Fish. Res. Bd. Canada Technical Report No. 364 (Manuscript Status), 18 p.

The hatchery operation significantly increased survival to the fry stage. At an average value of 74.9% from green eggs to migrant fry for this operation, the Headquarters Creek pilot operations are beginning to approach a level of production that should be routinely achievable. Production levels should reach 80-90% of green eggs available. This amounts to a ten-fold increase over what may be considered average coastal stream production; e.g. a recorded 14-year average survival of pink salmon in Hook Nose Creek was 7.3%. (From Auth.'s conclusions and discussion).

16382. Rickards, William L. (Sea Grant Program, School of Public Health, Univ. of North Carolina, Chapel Hill, North Carolina 27514). 1973. A BIBLIOGRAPHY OF ARTIFICIAL REEFS AND OTHER MAN-MADE FISH ATTRACTANTS. Univ. of N. C., Sea Grant Publication UNC-SG-73-04, 21 p.

Contains literature citations relating to a variety of man-made fish attractants, i.e. floating and off-bottom structures as well as conventional artificial reefs. Also included are selected biological and ecological references concerning fouling organisms, bottom communities, and reef and estuarine fishes of recreational importance. (Auth.)

16383. Schultz, Donald P. (Fish-Pesticide Res. Lab., Bur. of Sport Fish. & Wildl., Columbia, Missouri 65201). 1973. DYNAMICS OF A SALT OF (2,4-DICHLOROPHENOXY) ACETIC ACID IN FISH, WATER, AND HYDROSOL. Reprint from Agricultural and Food Chemistry, 21(2): p. 186.

The uptake, distribution, and dissipation of ^{14}C-labeled dimethylamine salt of (2,4-dichlorophenoxy) acetic acid (DMA-2,4-D) from water by three species of fish was studied concurrently with the dissipation of DMA-2,4-D from water and hydrosol. Fish were exposed to 0.5, 1.0, or 2.0 mg/l. concentrations of herbicide for up to 84 days. Radioactive residues of 2,4-D were determined by radiometric procedures in eight or more tissues and organs. Residues of 2,4-D were determined in muscle and whole-body extracts by gas chromatography. Radioactive residues were found in all fish tissues and organs analyzed, but actual 2,4-D content was negligible in muscle, indicating that most of the ^{14}C-residue was a metabolite(s) of 2,4-D. Residues of 2,4-D declined in water to less than 0.1 mg/l. after 35 days and in hydrosol to less than 0.1 mg/kg after 14 days. (Auth.)

16384. Soikkeli, Martti (Dept. of Zool., Univ. of Turku, Finland). 1973. TAGGED SALMON SMOLTS IN THE DIET OF THE CASPIAN TERN. Swedish Salmon Research Institute Report Laxforskningsinstitutet Meddelande 3, 5 p.

It is suggested that smolts in the diet of the Caspian tern are fish preyed upon just after release in shallow waters or close to the sea surface where some migrating smolts rise when getting weaker. Due to this reason of predation, as well as the relative scarcity of the Caspian tern in Baltic waters, it is thought that the Caspian tern does not affect the Baltic salmon or trout population in any remarkable way.

16385. Iuchi, Ichiro (Zool. Inst., Fac. of Sci., Univ. of Tokyo, Bunkyo, Tokyo, Japan). 1973. CHEMICAL AND PHYSIOLOGICAL PROPERTIES OF THE LARVAL AND THE ADULT HEMOGLOBINS IN RAINBOW TROUT, Salmo gairdnerii irideus. Comp. Biochem. Physiol., 44(4B): 1087-1101.

Comparative studies on chemical and physiological characteristics of hemoglobins isolated from newly hatched larvae and adult fish of rainbow trout were carried out. No significant differences in absorption spectrum and in molecular size were observed between them, suggesting that both hemoglobins are tetrameric and contain protoporphyrin IX. The larval hemoglobin was more labile than the adult one upon alkali denaturation. Electrophoretic studies revealed that both hemoglobins and their subunits were highly polymorphic, without having subunit components common to both hemoglobins. Although overall amino acid compositions of both hemoglobins were similar in general, the difference in the amino acid residues responsible for net charges at pH 8.6 was observed. The larval hemoglobin was characterized with higher oxygen affinity and less Bohr effect compared with the adult hemoglobin which loses oxygen affinity sharply at pH's below 7.6. (Auth.)

16386. U. S. Department of the Interior, Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife (Washington, D. C.). 1973. THREATENED WILDLIFE OF THE UNITED STATES. Office of Endangered Species and International Activities Resource Publication 114 (Revised Resource Publication 34), 289 p. For sale by Supt. of Documents, U. S. Govt. Printing Office, Washington, D. C.

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16387. Wernick, A., and H. Künnemann (Zool. Inst. der Univ. Kiel, Kiel, Germany). 1973. THE INFLUENCE OF TEMPERATURE ON SUBSTRATE-AFFINITY OF LACTATE-DEHYDROGENASE FROM FISHES (Der Einfluss der Temperatur auf die Substrat-Affinität der Laktat-Dehydrogenase aus Fischen). Marine Biology, 18(1): 32-36. In German with English abstract.

If the activity of lactate-dehydrogenase (LDH) at small pyruvate concentrations (e.g. 20 μM), as found in vivo, is measured, no temperature-dependence of the reaction-velocity is noted. This finding implies, for a poikilothermic animal (e.g. the fish Rhodeus amarus), that in physiological substrate concentrations, the velocity of enzymatic reaction is temperature-independent. In the LDH of R. amarus acclimated to 10° or 20°C, the enzyme-substrate-affinity, as judged by the Michaelis-constant (K_M), changes inversely with temperature. In contrast to R. amarus, K_M-values of Idus idus have a minimum temperature range identical to the adaptation temperature (AT). The momentary AT (e.g. 10°, 20°C) induces the disposition of an enzyme with greatest substrate-affinity at that temperature, which coincides with the AT. Estimating the activation energy ($E^1a = \mu$) through the Arrhenius-plot E^1a for LDH of Idus idus amounts to 8.2 kcal/mol in the experimental temperature (ET) range of 5° to 15°C. For ETs above 15°C, a value of E^1a = 12 kcal/mol is found. LDH of I. idus of 20°C, however, shows a smaller value of E^1a = 7.8 kcal/mol beyond ET = 15°C, below ET = 15°C, E^1a = 10 kcal/mol. If the AT of R. amarus of 10°C is raised to 25°C, and the K_M of LDH for substrate pyruvate and cosubstrate NADH (ET always 25°C) is measured, a dampened oscillation-like curve will be found, depending on time. (Authors)

16388. Parker, E. Davis, Michael F. Hirshfield, and J. Whitfield Gibbons (Savannah River Ecology Lab., Aiken, South Carolina). 1973. ECOLOGICAL COMPARISONS OF THERMALLY AFFECTED AQUATIC ENVIRONMENTS. J. Wat. Poll. Contr. Fed., 45(4): 726-733.

Ecological comparisons were made of three South Carolina reservoirs differently affected by thermal effluent from nuclear reactors. One of the reservoirs received thermal effluent, another was recovering from thermal loading, and the third study area had had no direct elevation of water temperatures. The reservoirs were compared in species composition of vascular aquatic plants, fish, and reptiles and in relative abundance of shoreline vegetation. One obvious effect was the elimination of certain species of vascular plants and aquatic vertebrates, resulting in a lowered diversity. Relative abundance of most species of shoreline plants was reduced in the heated areas. This effect was noticeable until at least 6 yr following the termination of thermal input. (Authors)

16389. Mague, T. H., and R. H. Burris (Dept. of Biochem., Coll. of Agric. and Life Sci., Univ. of Wisconsin, Madison, Wisconsin). 1973. BIOLOGICAL NITROGEN FIXATION IN THE GREAT LAKES. Bioscience, 23(4): 236-239.

Acetylene reduction (a measure of biological N_2 fixation) by the phytoplankton in Lake Superior, the western end of Lake Huron, and eastern Lake Michigan was barely detectable in September of 1970, but in southern Green Bay of Lake Michigan and the shallow basin of Lake Erie it was comparable in rate to that in eutrophic Wisconsin lakes. Acetylene reduction activity in Green Bay was low in the mouth of the main tributary, increased to a maximum 5-15 km northeast into the bay, and then decreased farther northeast. Vigorous acetylene reduction was always associated with an abundance of heterocystous blue-green algae. (Authors' summ.)

16390. Almeida, Silverio P., Donald R. Del Balzo, John Cairns, Jr., Kenneth L. Dickson, and Guy R. Lanza (Dept. of Physics, Va. Polytechnic Inst. and State Univ., Blacksburg, Virginia). 1971. HOLOGRAPHIC MICROSCOPY OF DIATOMS. Trans. Kansas Acad. Sci., 74(3-4): 257-260.

Holographic microscopy techniques were used to examine single-celled algae, i.e., diatoms. Holograms were made and reconstructed images obtained for Navicula sp. and Cyclotella sp. diatoms. The holographic methods presented provide another means for the study of detailed microscopic cells. (Authors)

16391. Døving, K. B., P. S. Enger, and H. Nordeng (Inst. of Zoophysiol. and Zool. Lab., Univ. of Oslo, Norway). 1973. ELECTROPHYSIOLOGICAL STUDIES ON THE OLFACTORY SENSE IN CHAR (Salmo alpinus L.). Comp. Biochem. Physiol., 45(1A): 21-24.

Brain activity was recorded from the olfactory bulb and telencephalon of migratory and non-migratory chars, Salmo alpinus. Stimulation of the olfactory epithelium with water in which other fishes had been swimming elicited conspicuous responses. The activity evoked by stimulation with mucus of the skin was larger than those elicited by extracts from other organs and the stimulating properties of the mucus retained its potence after heating and storage. The possible role of pheromones in fish migration is discussed. (Authors)

16392. Webb, P. W., and J. R. Brett (Fish. Res. Bd. of Canada, Pacific Biol. Sta., Nanaimo, British Columbia, Canada). 1973. EFFECTS OF SUBLETHAL CONCENTRATIONS OF SODIUM PENTACHLOROPHENATE ON GROWTH RATE, FOOD CONVERSION EFFICIENCY, AND SWIMMING PERFORMANCE IN UNDER-YEARLING SOCKEYE SALMON (Oncorhynchus nerka). J. Fish. Res. Bd. Canada, 30(4): 499-507.

Tests were performed at 15 C, pH 6.8, and dissolved oxygen values of 90-100% air saturation. Growth rate and conversion efficiency were measured by feeding a ration level of 15% body dry weight/day to underyearling sockeye salmon (Oncorhynchus nerka) held at sodium pentachlorophenate (PCP) concentrations of 0, 1.14, 1.99, 3.49, 7.16, 13.60, 27.73, 31.57 and 47.18 ppb. Swimming performance was measured at PCP concentrations of 0, 7.21, 19.00, and 50.00 ppb. The 96-hr LC50 was 63 ppb PCP. Growth rate and conversion efficiency were almost equally affected by PCP, the EC50 values being 1.74 ppb for growth rate and 1.80 ppb for conversion efficiency. This is approximately 2.8% of the 96-hr LC50. Swimming performance was unaffected by PCP at the concentrations used. (Authors)

16393. Sherburne, Stuart W. (Northeast Fish. Center, NMFS, NOAA, West Boothbay Harbor, Maine 04575). 1973. ERYTHROCYTE DEGENERATION IN THE ATLANTIC HERRING, Clupea harengus harengus L. NOAA Fishery Bull., 71(1): 125-134.

Cytoplasmic inclusions, associated with erythrocytic degeneration, were found in the circulating blood of herring from Boothbay Harbor, Maine, and from Passamaquoddy Bay at Deer Island, N.B., Canada, in 1969. Except in one instance, when inclusions occurred in herring from water of 2°C, all herring from Boothbay Harbor having inclusions were taken from seawater temperatures of 13.8°C or above. A relationship appears to exist between inclusions in herring erythrocytes and stress factors, especially temperature extremes. At a temperature of 16°C, 96% of a sample of herring were affected with inclusions. Herring sampled at the highest temperature (16°C) were markedly different from all other samples in their blood morphology and had the highest incidence of inclusions. Inclusions were found in the Passamaquoddy Bay area in 2 of the 50 herring sampled from a seawater temperature of 9.8°C, the highest temperature sampled in that area. Inclusions rarely occurred more than one to a red cell and varied in size from 1.3 to 3.9 μ. In herring containing a high incidence of inclusions, the larger inclusions were usually in the youngest red cells. Cells containing inclusions generally appeared rounded and swollen. Either an abnormally high percentage of up to 90% immature red cells or a low of 1 to 5% immature red cells generally characterized herring containing inclusions. (Auth.)

16394. Hendrix, Sherman S. (Dept. of Zool., Univ. of Maryland, College Park, Maryland). 1973. Plagioporus hypentelii sp. n. (TREMATODA: OPECOELIDAE) FROM THE HOGSUCKER, Hypentelium nigricans (LeSueur) (OSTEICHTHYS: CATOSTOMIDAE). Proc. Helm. Soc. Wash., 40(1): 144-146.

Plagioporus hypentelii sp. n. (Trematoda: Opecoelidae) is described from the intestine of the hogsucker, Hypentelium nigricans (Le Sueur) in streams of Adams County, Pennsylvania. It most closely resembles P. serotinus Stafford, 1904, but differs from it chiefly in its less elongate shape, smaller size, smaller testes, ovary, and eggs, straight cirrus sac, in hosts and geographic location of the hosts. (Auth.)

16395. Cowey, C. B., J. A. Pope, J. W. Adron, and A. Blair (Inst. of Marine Biochem., St. Fittick's Rd., Aberdeen, AB1 3RA, Scotland). 1972. STUDIES ON THE NUTRITION OF MARINE FLATFISH. THE PROTEIN REQUIREMENT OF PLAICE (Pleuronectes platessa). Brit. J. Nutr., No. 28, pp. 447-456; NOAA Marine Fisheries Abstracts, 26(4): p. 21, 1973.

A high dietary protein requirement by several species of fish has been reported elsewhere. Dose-response is the criterion. For example, the chinook salmon dose-response curve for dietary protein levels off at a protein concentration between 40 and 55%, depending on temperature, and at 40% for channel catfish. The dietary protein requirement of young plaice in water at 15°C was examined by feeding six rations containing protein at equally spaced concentrations between 20 and 70% of the dry diet. The protein source was freeze dried cod muscle. The results indicate that weight gain increased steadily up to a level of about 50% protein in the diet and subsequently fell. The authors suggest the possibility that very high dietary protein levels may depress growth rate. The estimated dietary protein requirement of plaice for optimum growth was found to be 52%, the same order as that reported for other carnivorous fish. Net protein utilization and protein efficiency ratio were measured at each dietary protein level. The results indicated less efficient utilization of dietary protein by plaice than by rats. The gross composition of the plaice in the experiment also varied with protein dietary level; the carcass protein content increased with dietary protein level. The plaice carcass in the experiment had greater lipid content than that of wild plaice, and the larger amounts probably reflected the levels of lipid in the diets.

16396. Holak, W., B. Krinitz, and J. C. Williams (Food and Drug Admn., Brooklyn, New York). 1972. SIMPLE, RAPID DIGESTION TECHNIQUE FOR THE DETERMINATION OF MERCURY IN FISH BY FLAMELESS ATOMIC ABSORPTION. J. Assn. Off. Analytical Chemists, 55(4): 741-742; Selected Water Resources Abstracts, 6(9): p. 42, 1973.

A simple and rapid digestion technique is described for the determination of mercury in fish by flameless atomic absorption. The sample is digested with nitric acid in a closed system in a commercially available vessel made of Teflon. A 30-min digestion at 150 C is sufficient to convert the mercury to an inorganic form so that it can be reduced to the elemental state, aerated, and determined by atomic absorption. The proposed digestion compares favorably with the official AOAC sulfuric-nitric-perchloric acid digestion.

16397. Deneke, Carl F., and R. R. Colwell (Dept. Biol., Georgetown Univ., Washington, D. C.). 1973. STUDIES OF THE CELL ENVELOPE OF Vibrio parahaemolyticus. Can. J. Microbiol., 19: 241-245; Fish Health News prepared at Eastern Fish Disease Lab., Kearneysville, W. Va., 2(2): p. 9.

Components of the cell envelope of Vibrio parahaemolyticus were investigated. Vibrio parahaemolyticus is an estuarine microorganism associated with diseases of marine and estuarine animals and seafood-borne enteritis in man. Purified lipopolysaccaride (LPS), isolated using a 45% phenol extraction procedure, was found to contain lipid A fraction to 27% of the LPS by weight. In the lipid A fraction, glucosamine was the only amino sugar to be present and a high molar ratio of phosphate to amino sugar (2.5:1) was noted. Two hydroxy fatty acids, hydroxyododecanoic and hydroxymyristic, were identified among the fatty acids by gas-liquid chromatography. (Authors' summ.)

16398. Tsai, Chu-fa (Natural Resources Inst., Univ. of Md., College Park, Maryland 20742). 1973. WATER QUALITY AND FISH LIFE BELOW SEWAGE OUTFALLS. Trans. Amer. Fish. Soc., 102(2): 281-292.

Comparative studies of water quality and fish species diversity in stream locations immediately above and below the outfalls of 149 secondary sewage treatment plants were made in Virginia, Maryland, and Pennsylvania. Sewage chlorine and turbidity increment resulting from sludge were found to be major causative factors for fish species diversity reduction below the outfalls. (Auth.)

16399. Burdick, G. E., Howard J. Dean, Earl J. Harris, Jack Skea, Ralph Karcher, and Charles Frisa (N. Y. State Dept. of Environ. Conservation). 1972. EFFECT OF RATE AND DURATION OF FEEDING DDT ON THE REPRODUCTION OF SALMONID FISHES REARED AND HELD UNDER CONTROLLED CONDITIONS. N. Y. Fish and Game Journal, 19(2): 97-115.

Losses of fry during various periods of development are compared for brown trout and brook trout hatched from eggs taken from females fed DDT at different concentrations and for various lengths of time, and for control fish held under identical conditions and fed the same ration except for DDT. Significant differences for the various periods of development were determined by the "t" test. Only one period, from swim-up (i.e., when hatchery feeding is normally begun) for a specified time thereafter, showed significant losses, depending on the time DDT was fed before spawning and the weekly dosage in milligrams per kilogram of body weight. DDT was confirmed as the cause of approximately 100 percent mortality of lake trout fry reared from eggs taken after adding 6 milligrams of DDT per kilogram of body weight to the weekly diet of potential breeders that had been reared from the egg at normal hatchery procedures until they neared maturity. A single control had no recorded loss of fry during this period. (Authors)

16400. Legeza, M. I. (Azerbaydzhanian Div., Central Sturgeon Fish. Res. Inst., (TsNIORKh), Baku). 1972. THE ROLE OF ABIOTIC FACTORS IN THE DISTRIBUTION OF STURGEONS (PISCES, ACIPENSERIDAE) IN THE CASPIAN SEA. J. Ichthyol., 12(1): 10-20.

The part played by environmental abiotic factors (depths, bottom materials, near-bottom temperatures and salinity, oxygen content near the bottom, currents and current velocities) in the distribution of the abundant forms of sturgeons in the Caspian Sea is here shown on the basis of extensive factual material. The differences between these fish in relation to the factors selected are established and it is demonstrated that each factor plays an important role in the life of sturgeons. The discovery of these differences helps to establish the basic patterns in the distribution of sturgeons in the sea, which should have adaptive significance.

16401. Davis, John C. (Fish. Res. Bd. Canada, Pacific Environ. Inst., 4160 Marine Drive, West Vancouver, B. C., Canada). 1973. SUBLETHAL EFFECTS OF BLEACHED KRAFT PULP MILL EFFLUENT ON RESPIRATION AND CIRCULATION IN SOCKEYE SALMON (Oncorhynchus nerka). J. Fish. Res. Bd. Canada, 30(3): 369-377.

Sublethal effects of aerated neutralized, filtered, full bleach kraft mill effluent (BKME) on circulation and respiration of Pacific salmon were examined. Ventilatory water flow, oxygen uptake, cough frequency, and buccal pressure increased in a group of 19 sockeye salmon, Oncorhynchus nerka, 207-321 g, at 10.5 ± 0.5 C, upon initial exposure to sublethal BKME concentrations. The threshold concentration for these responses appeared to be around 20% of the 4 day LC50 (static bioassay). Following overnight exposure to BKME, ventilatory volume, oxygen uptake rate, cough frequency, and oxygen utilization tended to approach pre-exposure levels, particularly at the higher sublethal contractions. Changing effluent toxicity, acclimation phenomena, or physiological adjustment are discussed as possible explanations for these results. Measures of arterial oxygen tension in sockeye salmon indicated that arterial tension declines rapidly and remains depressed following up to 24 hr exposure to BKME (33-45% of 4 day LC50). On the average this decline represented a 20% decrease in oxygen saturation of the blood. Decreased arterial PO_2 may be due to mucous production at the gills and resulting gas diffusion problems. as well as abnormalities in ventilation. Reduction in scope for activity might result from impaired oxygen uptake at the gills. A similar response was observed in rainbow trout, Salmo gairdneri. (Auth.)

16402. Resh, Vincent H., Claude R. Baker, and William M. Clay (Dept. of Biol., Univ. of Louisville, Louisville, Kentucky 40208). 1972. A PRELIMINARY LIST OF THE FISHES OF THE LAND BETWEEN THE LAKES, CUMBERLAND AND TENNESSEE RIVER DRAINAGES, KENTUCKY. Trans. Kentucky Acad. of Sci., 33(3-4): 73-80.

16403. Eastman, Joseph T., and James C. Underhill (Dept. of Anat. Sci., Univ. of Okla., Oklahoma City, Oklahoma). 1973. INTRASPECIFIC VARIATION IN THE PHARYNGEAL TOOTH FORMULAE OF SOME CYPRINID FISHES. Copeia No. 1, 45-53.

Forty-two species of cyprinids were studied to determine the amount of intraspecific variation in their pharyngeal tooth formulae. Widely different degrees of variation were found to exist. The percentage of arches, in a given species, bearing variant half-formulae ranged from 0 to 49.2%. The 0.4-4.0 formula was almost invariable whereas most of the species with 0.5-5.0; 2.5-4.2; or 1.4-4.1 formulae exhibited small or intermediate amounts of variation. The 2.4-4.2 condition was the most variable with four species possessing high percentages (5.8% to 49.2%) of deviant half-formulae. Some of the variability in certain formulae was attributed to evolutionary trends tending to decrease the number of minor-row teeth or increase the number of major-row teeth. A functional mechanism influencing the trends was offered. Faulty tooth replacement was also thought to contribute to some of the variation encountered. Because of the variability in certain formulae, it is suggested that pharyngeal arch and tooth characteristics should also be included in species descriptions and keys. (Authors)

16404. Weisbart, Melvin (Dept. of Biol., Wayne State Univ., Detroit, Michigan). 1973. THE DISTRIBUTION AND TISSUE RETENTION OF MERCURY-203 IN THE GOLDFISH (Carassius auratus). Canad. J. Zool., 51(2): 143-150.

Goldfish injected intraperitoneally with $^{203}Hg(NO_3)_2$ lost mercury at an apparent constant rate resulting in a biological half-life of 568 h. Correlated with this loss was a linear increase in the amount of mercury in the water. The mercury-203 content in the tissues displayed four different responses. (1) Gall bladder, gonad, and spleen tissues showed no significant regressions. (2) Eye, kidney, and intestinal tissue manifested significant losses of mercury, but the rate of loss was not significantly different from that of the body as a whole. (3) Gill, heart, skin, and swim bladder tissues lost mercury at rates faster than the body as a whole. (4) Brain, liver, muscle, and head kidney tissues showed no significant losses of mercury. (Auth.)

16405. Braber, L., and S. J. de Groot (Netherlands Inst. for Fish. Investigations, Ymuiden, The Netherlands). 1973. ON THE MORPHOLOGY OF THE ALIMENTARY TRACT OF FLATFISHES (PLEURONECTIFORMES). J. Fish Biol., 5(2): 147-153.

The changes during the life cycle in the relative length of certain parts of the alimentary tract, buccal-pharyngeal cavity, oesophagus-stomach, intestine, rectum are investigated in the five North Sea flatfish species, viz. turbot, brill, plaice, dab, sole. According to the average ratio between the length of the alimentary tract and the food preference three main groups are distinguished. (Authors)

16406. Joiner, Ronald L., Howard W. Chambers, and Karl P. Baetcke (Dept. of Entomol. and Dept. of Biochem., Miss. Agric. and Forestry Exper. Sta., Miss. State Univ., State College, Mississippi). 1973. COMPARATIVE INHIBITION OF BOLL WEEVIL, GOLDEN SHINER, AND WHITE RAT CHOLINESTERASES BY SELECTED PHOTOALTERATION PRODUCTS OF PARATHION. Pesticide Biochem. and Physiol., 2(4): 371-376.

The effect of seven photoalteration products of parathion and the parent compound itself on fish (golden shiner), mammal (white rat), and insect (boll weevil) cholinesterases are compared. The white rat cholinesterase was found to be more susceptible to inhibition by photoalteration products of parathion than the golden shiner and boll weevil cholinesterases. In every instance in which inhibition occurred, the phosphate analogs were determined to be more potent anticholinesterase agents than the corresponding phosphorothioate analogs. (Authors)

16407. Barbour, Clyde D. (Dept. of Biol., Univ. of Utah, Salt Lake City, Utah). 1973. THE SYSTEMATICS AND EVOLUTION OF THE GENUS Chirostoma Swainson (PISCES, ATHERINIDAE). Tulane Studies in Zoology and Botany, 18(3): 97-141.

16408. Forney, John L. (Dept. of Natural Resources, Cornell Univ., Ithaca, New York). 1972. BIOLOGY AND MANAGEMENT OF SMALLMOUTH BASS IN ONEIDA LAKE, NEW YORK. N. Y. Fish and Game Journal, 19(2): 132-154.

Age composition and growth rate of smallmouth bass in Oneida Lake were determined from scales and measurements collected from 1952 to 1970. Dominant year classes were produced in years when mean June air temperatures were above normal. The catch of young bass in seine hauls indicated that year-class size was established by August, but the causal relation between June air temperature and year-class survival was not established. The long-term average growth rate of bass was stable between 1949 and 1966, but annual growth increments varied markedly. Much of this variation was attributable to differences in mean summer air temperatures and the abundance of young yellow perch which were an important forage species. Annual survival and minimum rates of exploitation were determined from tag returns reported by anglers. The mean annual survival during a 14-year period was 0.57 which agreed closely with estimates from catch curves. A linear regression was fitted to annual survival rates and minimum rates of exploitation to obtain an estimate of natural mortality. The intercept in the event of no fishing corresponded to a natural mortality rate of 0.125. The role of regulations and stocking in the management of the population is examined. (Auth.)

16409. Patalas, Kazimierz, and Alex Salki (Fish. Res. Bd. of Canada Freshwater Inst., Winnipeg 19, Manitoba, Canada). 1973. CRUSTACEAN PLANKTON AND THE EUTROPHICATION OF LAKES IN THE OKANAGAN VALLEY, BRITISH COLUMBIA. J. Fish. Res. Bd. Canada, 30(4): 519-542.

In early September 1969 and late August 1971, the vertical and horizontal distribution of temperature, Secchi disc visibility, some chemical components, and zooplankton abundance in lakes Okanagan, Skaha, and Osoyoos were investigated. In addition, lakes Kalamalka and Wood were sampled only in late August 1971. Four different basins could be distinguished in Lake Okanagan: the Penticton-Summerland basin, the Peachland-Kelowna basin, a basin north of Kelowna, and one formed by the northern end of the lake. Total dissolved solids, calcium, and electrical conductivity within the lake decreased gradually from north to south. Macroelement values within lakes Okanagan, Skaha, and Osoyoos were apparently not substantially different but Kalamalka and Wood lakes were about twice higher in sodium, potassium, magnesium, and about 1.5 higher in total dissolved solids. Four species of copepods and nine species of cladocerans were found with Cyclops bicuspidatus thomasi and Diaptomus ashlandi dominant in all five lakes. Diaphanosoma leuchtenbergianum and Daphnia longiremis were the most common cladocerans in all five lakes. Also, Daphnia thorata was common in all except Wood Lake. Eighty-nine percent of the total plankters in Lake Okanagan were located in the upper 50-m layer. Relatively little horizontal variation was found within the lake but two areas, near Kelowna and in the northern end showed in both years of investigation greater abundance of plankton than the remaining areas. Crustaceans were usually less abundant inshore than offshore. Volume of settled net plankton varied from 8 mm^3/cm^2 in Okanagan Lake to 31 mm^3/cm^2 in Wood Lake. No substantial changes in species composition of zooplankton, Secchi disc visibility, and dissolved oxygen in the hypolimnion were found relative to the data of 1935 reported by Rawson. However, in 1969 and 1971 net plankton volumes were about five and three times larger, respectively, than in 1935. Calculations of total phosphorus load from two independent sources of data provided similar results and indicated that lakes Okanagan and Kalamalka are still in the oligotrophic range but close to mesotrophy. Lake Wood is moderately eutrophic and lakes Skaha and Osoyoos showed a marked degree of eutrophy, higher than in Lake Washington, U.S.A. before sewage diversion, or in Lake Erie. The estimates for lakes Wood, Skaha, and Osoyoos were supported by the values of the hypolimnetic areal deficits characteristic for highly eutrophic lakes. The trend of changes in phosphorus load during the past century is presented and predictions are made about the load in 1990 in situations with and without phosphorus removal from sewage. (Authors)

16410. Hida, Thomas S. (Southwest Fish. Center, NMFS, NOAA, Honolulu, Hawaii 96812). 1973. FOOD OF TUNAS AND DOLPHINS (PISCES: SCOMBRIDAE AND CORYPHAENIDAE) WITH EMPHASIS ON THE DISTRIBUTION AND BIOLOGY OF THEIR PREY Stolephorus buccaneeri (ENGRAULIDAE). NOAA Fishery Bull., 71(1): 135-143.

The results of examining the stomach contents of skipjack tuna (Katsuwonus pelamis), bigeye tuna (Thunnus obesus), yellowfin tuna (Thunnus albacares), kawakawa (Euthynnus affinis), common dolphin (Coryphaena hippurus), and the little dolphin (Coryphaena equisetis) caught by live bait pole-and-line fishing and trolling in the equatorial eastern Pacific and around the Samoa Islands are presented. Fishes, crustaceans, and molluscs were found to be important food items. The presence of the anchovy, Stolephorus buccaneeri, among the stomach contents was of particular interest, and information gained on their distribution, size frequency, fecundity, and food habits is presented. (Auth.)

16411. Rao, K. S. P. Bhushana, and Ch. Gerday (Lab. of Gen. Biol., Fac. of Sciences, Univ. of Liege, B-4000 Liege, Belgium). 1973. LOW MOLECULAR WEIGHT PROTEINS OF PIKE (Esox lucius) WHITE MUSCLES - II. CHEMICAL AND PHYSICAL PROPERTIES. Comp. Biochem. Physiol., 44(4B): 1113-1125.

The amino acid compositions of the two low molecular weight proteins extracted from pike muscles are typical of this protein's family. . The molecular weights are 11,525 and 11,740 respectively for components II and III. Their tryptic peptide maps show large dissimilarities. The N-terminal groups are acetylated and alanine is the C-terminal residue in both proteins. For the two proteins 58 percent helicity was calculated from O. R. D. data. These results are compared with similar measurements on four low molecular weight proteins extracted from carp. (Authors)

16412. Havelka, J. 1970. DETERMINATION OF THE HAEMATOCRITE VALUE OF CARPS, AND THE EFFECT OF COBALT ON THIS VALUE. (Stanoveni hematokritove-hodnoty kapru a jeji ovlivneni kobaltem). Zivoc. Vyroba, 15(7-8): 489-496, summaries in English, Russian and German; Agric. Literature of Czechoslovakia, 3-4, No. 807, p. 174, 1971.

It is recommended to add cobalt to the feed, in the form of cobalt dichloride/ $CoCl_2$/ in the daily doses of 1 mg/kg of live weight of carp fry and two-year-old carp stock. Cobalt exerts a favorable influence on the physiology of blood which is manifested in increased capacity of respiration and in the promotion of the resisting capacity of carps against infections. The effect of cobalt was tested by means of the examination of the following blood indices: number of red blood corpuscles, content of haemoglobin, sedimentation rate, haematocrite value and the mean volume of red blood corpuscles. In healthy carps /K_2/ haematocrite was found to be higher than 40% to 60%, and in K_2 diseased with infectious dropsy the mentioned value was less than 35% - in acute cases less than 20%. Haematocrite rate increases in the course of the vegetation period; a decrease occurs in autumn, in the course of the winter period, and in spring after wintering of fish.

16413. Anderson, J. (Va. State Water Control Bd., Richmond, Virginia). 1972. WET DIGESTION VERSUS DRY ASHING FOR THE ANALYSIS OF FISH TISSUE FOR TRACE METALS. Atomic Absorption Newsletter, 11(4): 88-89; Selected Water Resources Abstracts, 6(9): p. 42.

Fish samples for analysis were frozen and ground and divided for dry ashing and wet digestion. Ashing was performed at 500 C for 16 hours after which 5 ml of concentrated nitric acid and later, deionized water were added. Wet digestion was performed by adding 2 ml of perchloric acid and 10 ml of nitric acid, heating at 95 C until fats were completely broken down. Ten ml of deionized water was then added to samples. Metal concentrations were measured by direct aspiration into a Perkin-Elmer atomic absorption spectrophotometer. Lead was measured using the Sampling Boat technique. It is concluded from the results of the analysis for Zn, Cr, Cu, Cl, and Pb that the dry-ash method is much less time consuming in terms of manhours, can handle whole fish, has percent recoveries comparable to the wet digestion method, and produces less variation. Recoveries by each method exceeded 90 percent.

16414. Smith, Allan K. (Ore. State Game Comm., Portland, Oregon 97208). 1973. DEVELOPMENT AND APPLICATION OF SPAWNING VELOCITY AND DEPTH CRITERIA FOR OREGON SALMONIDS. Trans. Amer. Fish. Soc., 102(2): 312-316.

Water velocity and depth criteria were developed to formulate recommended stream flows for spawning of Oregon salmonids. Criteria have additional application in the design of artificial spawning channels. About 1,170 redd measurements of 10 species and races were made during a 10-year period. Mean redd velocities ranged between 0.11 and 0.73 m/sec and depths between 0.22 and 0.43 m for all species. A velocity range and minimum depth were found for each species which included 80% of the measurements with 95% confidence. The resulting criteria were compared with data and recommendations from Oregon and elsewhere. (Auth.)

16415. Greenfield, David, Fathi Abdel-Hameed, Gary D. Deckert, and Ronald R. Flinn (Dept. of Biol. Sci., Northern Ill. Univ., DeKalb, Illinois). 1973. HYBRIDIZATION BETWEEN Chrosomus erythrogaster AND Notropis cornutus (PISCES: CYPRINIDAE). Copeia No. 1, 54-60.

Hybrids between the southern redbelly dace, Chrosomus erythrogaster and the common shiner, Notropis cornutus have been found in Rickelson Creek, Lee County, Illinois. Meristic and morphometric analysis of 30 N. cornutus, 30 C. erythrogaster, and 14 hybrids has shown that the hybrids are most likely F_1's and that they are not intermediate between the parents in all characters. Karyotype analysis has shown that both parents have a diploid number of 50, but that they differ in the ratio of metacentric, and submetacentric pairs. The F_1 hydrids combine the two parental genomes. A discussion of the causes of hybridization is presented. (Authors)

16416. Vladykov, Vadim D. (Dept. of Biol., Univ. of Ottawa, Ottawa, Canada). 1973. A FEMALE SEA LAMPREY (Petromyzon marinus) WITH A TRUE ANAL FIN, AND THE QUESTION OF THE PRESENCE OF AN ANAL FIN IN PETROMYZONIDAE. Canad. J. Zool., 51(2): 221-224.

Description is given of a female sea lamprey (Petromyzon marinus) 498 mm long, which had a true anal fin, 31 mm in length supported by about 30 cartilaginous rays. The question of the presence of an anal fin in Petromyzonidae is also discussed. (Auth.)

16417. Meadows, B. S. (Salmon and Freshwater Fish. Lab., Min. of Agric., Fish. and Food, Whitehall Place, London, England). 1973. TOXICITY OF ROTENONE TO SOME SPECIES OF COARSE FISH AND INVERTEBRATES. J. Fish Biol., 5(2): 155-163.

The toxicity of rotenone was determined for seven species of fish and three species of invertebrates. The results show that there is a marked variation in sensitivity of different species to rotenone. The survival times of roach Rutilus rutilus (L.) were reduced by a rise in temperature and also by a reduction in water hardness. Temperature affected the rate at which rotenone is degraded; 3 days after being prepared a solution containing 2 mg/l of 5% rotenone was non-toxic to roach over a 7-day period at 20°C, but it was still toxic for at least 11 days at 11.5°C. The data are discussed in relation to the use of rotenone in fisheries management. (Auth.)

16418. Maggenti, A. R. (Dept. of Nematol., Univ. of Calif., Davis, California). 1973. ANTHELMINTICS FOR NEMATODE PARASITES OF FISH: I. CONTROL OF Sterliadochona pedispicula IN Salmo gairdnerii BY DIETHYL 2-CHLOROVINYL PHOSPHATE AND 2,2 DICHLOROVINYL DIMETHYL PHOSPHATE PELLETS. Proc. Helm. Soc. Wash., 40(1): 94-97.

Tests indicate that the oral administration of diethyl 2-chlorovinyl phosphate (SD 1836) and 2,2 dichlorovinyl dimethyl phosphate (DDVP) plastic-incorporated pellets significantly reduces the intestinal nematode parasite Sterliadochona pedispicula in wild rainbow trout. No evidence of fish toxicity was noted with the treatments and dosages tested. (Auth.)

16419. Brett, J. R., and N. R. Glass (Fish. Res. Bd. Canada Pacific Biol. Sta., Nanaimo, British Columbia, Canada). 1973. METABOLIC RATES AND CRITICAL SWIMMING SPEEDS OF SOCKEYE SALMON (Oncorhynchus nerka) IN RELATION TO SIZE AND TEMPERATURE. J. Fish. Res. Bd. Canada, 30(3): 379-387.

Ten years research on metabolic rates and swimming speeds of sockeye salmon (Oncorhynchus nerka) ranging in weight from 2 to 2000 g, at temperatures from 2 to 24 C, is reviewed and summarized. Analysis of weight-slope relations (b values) at three temperatures, using log-log transformations, provided an overall mean of 0.88 for standard metabolism and 0.99 for active metabolism. A previously determined semilog equation for temperature effect on standard metabolic rate (at approximately 50 g) was supported by supplementary data at 2 C. Predictive graphic models in the form of isopleths of metabolic rates and critical swimming speeds in relation to weight, length, and temperature are depicted. These provide a composite presentation useful in estimating the metabolic rate and maximum sustained speed for any size and temperature. (Authors)

16420. Romberg, Gerald P., and William C. Renfro (Dept. of Oceanogr., Ore. State Univ., Corvallis, Oregon 97331). 1973. RADIOACTIVITY IN JUVENILE COLUMBIA RIVER SALMON: A MODEL TO DISTINGUISH DIFFERENCES IN MOVEMENT AND FEEDING HABITS. Trans. Amer. Fish. Soc., 102(2): 317-322.

The ^{32}P specific activities and ^{65}Zn concentrations were measured in juvenile salmon collected from the Columbia River during winter and spring of 1969. An environmental uptake study involving marked juvenile chinook salmon indicated that ^{32}P specific activity values reach a maximum sooner than values for ^{65}Zn concentration. The uptake study also suggested a short lag period before hatchery fish released to the Columbia River began rapid uptake of ^{32}P and ^{65}Zn. A graphical model based on ^{32}P specific activities and ^{65}Zn concentrations was constructed which allows fish to be classified and differentiated with regard to their past feeding or movement behavior. Use of the model indicated that some hatchery fish released to the river either had feeding behavior unlike other hatchery fish or were not in the Columbia River the entire time from release until collection. Application of the model to a sample of 24 unmarked juvenile salmon collected from the Columbia River revealed several different groups of fish. (Authors)

16421. Kyung, Chang Khyu (Astrakhan Tech. Inst. for the Fish Industry and Fisheries, USSR). 1972. COMPOSITION OF SPAWNING STOCKS OF THE BIG-EYED SHAD [Alosa saposhnikovi (Grimm)] IN THE NORTH CASPIAN. J. Ichthyol., 12(1): 46-54.

An account is given of the results of observations on spawning stocks of the big-eyed shad [Alosa saposhnikovi (Grimm)] in the North Caspian. Information is given concerning the size and age composition of its stocks, the weight of individuals, the ratio of males and females, the state of gonad maturation and growth rate.

16422. Green, David M. (Dept. of Nat. Resources, Cornell Univ., Ithaca, New York). 1972. CHARACTERISTICS OF A SMALL-LAKE FISHERY AS DETERMINED BY A CREEL CENSUS. N. Y. Fish and Game Journal, 19(2): 155-167.

A creel census was conducted on a shallow 117.5-acre warm-water lake in central New York from June 1965 to March 1968. Species recorded in the anglers' catch were: largemouth bass, chain pickerel, brown bullhead, yellow perch, pumpkinseed and black crappie. Catch and effort were estimated for shore, boat and ice fishermen. Effort ranged from 6,887 to 11,874 man hours, with shore fishermen expending the greatest effort and ice fishermen the least. Monthly and daily distribution of effort was determined. Bullheads, pumpkinseeds and perch were the fish most frequently caught by shore fishermen, while pumpkinseeds, pickerel and perch sustained the boat fishermen. Boat fishermen caught over 80 percent of the bass taken. Perch were numerically the most important fish in the catch and comprised the bulk of the ice fishermen's catch. Ice fishermen also took a significant number of pickerel. Fish caught and released may be important in evaluating the quality of such a fishery. (Auth.)

16423. Gardner, D. R. (Dept. of Biol., Carleton Univ., Ottawa, Ontario, Canada) 1973. THE EFFECT OF SOME DDT AND METHOXYCHLOR ANALOGS ON TEMPERATURE SELECTION AND LETHALITY IN BROOK TROUT FINGERLINGS. Pesticide Biochem. and Physiol., 2(4): 437-446.

The effects of several DDT and methoxychlor analogs on trout fingerling temperature selection and lethality were investigated. The molecular requirements for lethality and alteration of temperature selection were different. Only p,p'-DDT, p,p'-DDD, and p,p'-methoxychlor were toxic in the range 10-50 ppb used. All the compounds tested, except DDE-type analogs, altered temperature selection. The effect of p,p'-methoxychlor on temperature selection progressively decreased until normal values were obtained 5 days after exposure. The effect of p,p'-DDT was still pronounced 9 days after exposure. (Auth.)

16424. Künnemann, H. (Zool. Inst. der Univ. Kiel, Kiel, Germany). 1973. THE INFLUENCE OF TEMPERATURE ON THERMOSTABILITY, ISOENZYME PATTERN AND REACTION KINETICS OF LACTATE DEHYDROGENASE FROM FISHES (Der Einfluss der Temperatur auf Thermostabilität, Isoenzym-Muster und Reaktionskinetik der Laktat-Dehydrogenase aus Fischen). Marine Biology, 18(1): 37-45. In German with English abstract.

Methodological problems complicate investigations on thermostability of lactate dehydrogenase (LDH). It is difficult to demonstrate a correlation between adaptation temperature (AT) and LDH thermostability. Heat-inactivation characteristics change completely if diluted or undiluted tissue extracts are heated. In purified LDH (purchased from Boehringer, Mannheim, FRG), additions such as casein, bovine-serum albumin, NADH and pyruvate - even in small concentrations - can alter considerably the degree of heat resistance. If LDH activity is measured as a function of experimental temperature (ET) according to the composition of the actual test mixture (e.g. altered pyruvate concentration), a different temperature optimum is found. If tissue extracts containing unpurified enzymes are used, the accompanying substances act on the enzyme and modify its properties. Thus, possible influence of AT on enzyme properties can be concealed (suppressed, overemphasized). In Idus idus acclimated to 10° or 20°C, brain, gill, gut and white dorsal muscle reveal identical LDH-isoenzyme patterns. However, liver-LDH shows a pattern dependent on the AT. A total of 11 bands with LDH activity were found. In 10°C fishes, the Isoenzymes 1, 3, 6 and 7 are especially active. However, 20°C fishes show marked activity of Isoenzymes 5 and 8, and a reduced activity of Isoenzyme 7. According to their electrophoretic mobility, the particular isoenzymes of LDH of white dorsal muscle of I. idus or Rhodeus amarus can be clearly distinguished. The ATs 10° or 20°C do not influence the dependence of reaction order on ET; this is not true for the velocity constant. (Auth.)

16425. Ballard, William W. (Biol. Dept., Dartmouth College, Hanover, New Hampshire). 1973. NORMAL EMBRYONIC STAGES FOR SALMONID FISHES, BASED ON Salmo gairdneri Richardson AND Salvelinus fontinalis (Mitchill). J. Exp. Zool., 184(1): 7-26.

As a byproduct of a re-examination of teleost morphogenetic movements, 23 stages in the normal development of salmonid fishes are presented, from fertilization to and beyond hatching, together with rates of their appearance at several constant temperatures. To aid in planning experiments, the period before closure of the germ ring is divided into 13 stages, with detailed discussion of internal structures and movements as well as external features, especially during gastrulation. The literature of salmonid development suggests that the stages are closely applicable to the embryos of any genera of suborder Salmonoidei, except as to the rates of their appearance. Illustrations are designed for ready identification of stages. To facilitate their correlation with the older morphological literature, the principal events of organogenesis in the ectodermal, mesodermal, and endodermal categories are listed according to the stages at which they occur, as determined by dissections and serial sections. (Auth.)

16426. Brylinsky, M., and K. H. Mann (Dept. of Biol., Dalhousie Univ., Halifax, Nova Scotia, Canada). 1973. AN ANALYSIS OF FACTORS GOVERNING PRODUCTIVITY IN LAKES AND RESERVOIRS. Limnol. & Oceanogr., 18(1): 1-14.

Data collected as part of the International Biological Program for 43 lakes and 12 reservoirs, distributed from the tropics to the arctic, were subjected to statistical analysis to establish which factors are important in controlling production and how they are related. In the whole body of data, variables related to solar energy input have a greater influence on production than variables related to nutrient concentration; in lakes within a narrow range of latitude, nutrient-related variables assume greater importance. Morphological factors have little influence on productivity per unit area in either case. Chlorophyll α concentration is a good indicator of nutrient conditions and when combined with an energy-related variable constitutes a good estimator of primary production. (Authors)

16427. Wildish, D. J., and D. Beatty (Fish. Res. Bd. of Canada, Biol. Sta., St. Andrews, New Brunswick, Canada). 1973. In Vitro HYDROLYSIS OF POLYOXYETHYLENE ESTERS BY TISSUES OF THE AMERICAN EEL AND ATLANTIC SALMON. Bull. Environ. Contamination and Toxicology, 9(4): 212-217.

The liver of Atlantic salmon and American eel hydrolyse POE esters at a rate dependent on POE chain length. Increasing POE chain length decreases V, possibly determined by the rate of breakdown of the enzyme/substrate complex. Substituting oleic for lauric acid in POE (9) ester results in decreased V and Km. Compared with the activity of acetone-dried beef liver (unpublished observations) hydrolytic rates are approximately 8 to 32 times less with eel and salmon liver and POE (14) monolaurate as substrate. If hydrolysis of POE esters does lead to partial detoxication in fish, it follows from this work that eels should be less susceptible to poisoning by POE esters than salmon and that the hydrolytic detoxication becomes progressively faster as the homologous series is descended. Both predictions are subject to other factors involved in poisoning such as uptake and excretion dynamics. (Authors' conclusions)

16428. Pienaar, L. V., and J. A. Thomson (Dept. of Forestry, Univ. of Ga., Athens, Georgia). 1973. THREE PROGRAMS USED IN POPULATION DYNAMICS WVONB - ALOMA - BHYLD (FORTRAN 1130). Fish. Res. Bd. of Canada Technical Report No. 367 (Manuscript status), 33 p.

Three programs are presented which have received much use at the Pacific Biological Station of the Fisheries Research Board of Canada. While the listings given are as used on a 16K work IBM 1130, they should be easily convertible to other systems. Source decks of the programs are available by writing to the Computer Center, Pacific Biological Station, FRB of Canada, Nanaimo, British Columbia. (A 360/65 version of WVONB is also available). (From Introduction)

16429. Pakkala, I. S., W. H. Gutenmann, D. J. Lisk, G. E. Burdick, and E. J. Harris (Cornell Univ., Ithaca, New York). 1972. A SURVEY OF THE SELENIUM CONTENT OF FISH FROM 49 NEW YORK STATE WATERS. Pesticides Monitoring Journal, 6(2): 107-114; Selected Water Resources Abstracts, 6(10): p. 38.

A survey was made of the selenium content of 438 fish of various species collected in 1969 from 49 New York State waters and a group of lake trout sampled in 1970 from Cayuga Lake only. Decapitated, eviscerated fish were chopped, mixed, and frozen in polyethylene bags prior to analysis. Selenium was determined by an adaptation of the Allaway and Cory method involving oxygen-flask combustion of dried fish and the determination of the fluorescence of the selenium 2, 3-dianinonaphthalene complex. The method was sensitive to about 0.1 ppm of Se in fish. Concentrations of selenium on a freshweight basis were usually below 1 ppm. There was little apparent correlation between selenium concentrations and species or sampling locations except that sturgeon from the Hudson River, lake trout from Lakes George and West Canada, whitefish from Raquette Lake, and several species from Lake Pleasant had consistently higher levels of selenium than other samples; all fish from Lakes Butterfield and Champlain and the Chenango and Salmon Rivers had consistently lower levels. No correlation was apparent between selenium levels and size or sex of fish. Selenium did not appear to be cumulative in lake trout of known age up to 12 years from Cayuga Lake.

16430. Blackett, R. F. (Sport Fish Div., Alaska Dept. of Fish & Game, Juneau, Alaska). 1973. FECUNDITY OF RESIDENT AND ANADROMOUS DOLLY VARDEN (Salvelinus malma) IN SOUTHEASTERN ALASKA. J. Fish. Res. Bd. Canada, 30(4): 543-548.

Fecundity of resident Dolly Varden (Salvelinus malma) in an isolated population of southeastern Alaska averaged 66 eggs per female in comparison with 1888 eggs for anadromous Dolly Varden from two nearby streams. A relatively large egg size, averaging 3.6 mm in diameter and overlapping the range for the anadromous char, has been retained by the females in the resident population. Curvilinear regressions between egg number and fish length and linear regressions between egg number and body and ovary weights show that resident females have fewer eggs per unit of length, approximately the same number of eggs per gram of body weight, and more eggs per gram of ovary weight than anadromous females. The resident char attain sexual maturity a year earlier in life and at a smaller size than the migratory char. Development of a larger left ovary containing more eggs than the right was a common occurence for both resident and anadromous Dolly Varden. (Auth.)

16431. Echelle, Anthony A. (Univ. of Okla. Biol. Sta., Kingston, Oklahoma). 1973. BEHAVIOR OF THE PUPFISH, Cyprinodon rubrofluviatilis. Copeia No. 1, 68-76.

Behavior in natural conditions is described for the Red River pupfish, Cyprinodon rubrofluviatilis. Spawning occurred from February into November at temperatures of 13-34 C, with a shift from primarily afternoon spawning in the winter to primarily morning spawning in warmer months. In March, spawning was observed from sunrise until nightfall on days when permissive temperatures prevailed. Maximum spawning frequencies were observed at midmorning hours in July and August. By late October spawning had decreased to a low level. Relative frequencies of different courtship activities were apparently correlated with differential levels of sexual readiness in the female population. Major functions of breeding territoriality seemed to be egg protection and the provision of space in which resident males could court females with minimal interference from other males. Blackening of the eye was a correlate of increased aggressiveness in females and nonbreeding males. In courting and spawning pairs, differential eye color, black in males, silvery in females, was correlated with apparent differences in aggressive motivation. (Auth.)

16432. Befus, A. D., and R. S. Freeman (Depts. of Parasitol. and Zool., Univ. of Toronto, Toronto, Ontario, Canada). 1973. Corallobothrium parafimbriatum sp. n. AND Corallotaenia minutia (Fritts, 1959) comb. n. (CESTODA: PROTEOCEPHALOIDEA) FROM ALGONQUIN PARK, ONTARIO. Canad. J. Zool., 51(2): 243-248.

Corallobothrium parafimbriatum sp. n. and Corallotaenia minutia (Fritts, 1959) comb. n. are reported from the brown bullhead, Ictalurus nebulosus, in Algonquin Park, Ontario; Corallobothrium fimbriatum, although reported previously, was not found. C. parafimbriatum is smaller, has fewer segments, testes, and uterine branches, and has a different egg than C. fimbriatum; secondary protonephridial pores are present on the former, but absent on the latter species. C. parafimbriatum is the same size as Corallotaenia minutia but differences in the vitelline columns, ovary, and eggs clearly distinguish the two. The genus Corallotaenia is amended. Since the paratype of Corallobothrium intermedium Fritts, 1959 has sphincters on two suckers, it is reassigned as Megathylacoides intermedium (Fritts, 1959) comb. n. (Authors)

16433. Moriarty, C. (Dept. of Agric. and Fish., Dublin, Ireland). 1973. A TECHNIQUE FOR EXAMINING EEL OTOLITHS. J. Fish Biol., 5(2): 183-184.

This note describes the use of a rib-cutting forceps in extracting the otoliths and a method of preparing permanently mounted specimens of burned otoliths. (Auth.)

16434. Lee, R. F., R. Sauerheber, and G. H. Dobbs (Scripps Inst. of Oceanogr., Univ. of Calif., La Jolla, California). 1972. UPTAKE, METABOLISM AND DISCHARGE OF POLYCYCLIC AROMATIC HYDROCARBONS BY MARINE FISH. Marine Biology, 17(3): 201-208.

The uptake, metabolism and discharge of two polycyclic aromatic hydrocarbons, ^{14}C-naphthalene and ^{3}H-3, 4-benzopyrene, were studied in 3 species of marine fish (mudsucker or sand goby, Gillichthys mirabilis; sculpin, Oligocottus maculosus; sand dab, Citharichthys stigmaeus). The path of hydrocarbons through the fish included entrance through the gills, metabolism by the liver, transfer of hydrocarbons and gills, metabolism by the liver, transfer of hydrocarbons and their metabolites to the bile, and, finally, excretion. The gall bladder was a major storage site of labeled hydrocarbons and their metabolites. The major product of ^{3}H-3, 4-benzopyrene metabolism was tentatively identified as 7, 8-dihydro-7, 8-dihydroxybenzopyrene. The ^{14}C-naphthalene was metabolized to 1, 2-dihydro-1, 2-dihydroxynaphthalene after 24 h exposure. The urine appeared to be the major avenue for discharge of labeled hydrocarbon from the body. Our laboratory results indicated that certain polycyclic aromatic hydrocarbons were rapidly taken up from seawater by the above fish, but detoxification mechanisms existed for efficient removal of these compounds from their body tissues. (Authors)

16435. Vladykov, Vadim D. (Dept. of Biol., Univ. of Ottawa, Ottawa, Canada). 1971. HOMING OF THE AMERICAN EEL, Anguilla rostrata, AS EVIDENCED BY RETURNS OF TRANSPLANTED TAGGED EELS IN NEW BRUNSWICK. The Canadian Field-Naturalist, 85(3): 241-248.

On September 29, 1968, 222 eels, ranging in length from 351 mm to 825 mm, caught in the Shediac River, were transported on the same day by automobile in a wooden box with wet marine plants, tagged and released about 50 miles (80 km) away in the Kouchibouguacis River. These New Brunswick rivers along the Northumberland Strait are separated by 8 rivers, 4 brooks and numerous sea inlets. Up to December 31, 1969, 15 recaptured eels (or nearly 7%) were reported of which four were retaken in the Shediac River, their home stream. These recaptures and data from controls suggest that homing was involved. At present there is no definite explanation how the transplanted eels were able to find their home river. (Auth.)

16436. Lindall, William N., Jr., John R. Hall, and Carl H. Saloman (Gulf Coastal Fish. Center, NMFS, NOAA, 75 33rd Ave., St. Petersburg, Florida 33706). 1973. FISHES, MACROINVERTEBRATES, AND HYDROLOGICAL CONDITIONS OF UPLAND CANALS IN TAMPA BAY, FLORIDA. NOAA Fishery Bull., 71(1): 155-163.

Faced with statutory restraints that prohibit dredging and filling of estuarine bottoms, coastal developers have turned to alternate methods of providing water front property for homesites. One method, recently used in Tampa Bay, Fla., is the construction of access canals that lead from open water to upland acreage. This paper presents biological and hydrological data from new upland canals together with some comparative data from older upland canals and bayfill canals. In all types of canals, as presently engineered, stratified, stagnant water causes low levels of dissolved oxygen in summer months, resulting in mortality or emigration among resident organisms. Means of alleviating the problems are discussed. (Authors)

16437. Spratt, Jerome D. 1973. AGE AND LENGTH COMPOSITION OF NORTHERN ANCHOVIES (Engraulis mordax) LANDED IN CALIFORNIA FOR REDUCTION DURING THE 1970-71 SEASON. Calif. Fish and Game, 59(2): 121-125.

Anchovy landings totaled 80, 752 tons during the 1970-71 season. Catch estimates were not calculated from central California landings due to a lack of data. Age groups I, II and III accounted for 92% of the catch in southern California. (Auth.)

16438. McLeay, D. J. (Div. of Applied Biol., B. C. Res., Vancouver 8, British Columbia, Canada). 1973. EFFECTS OF A 12-HR AND 25-DAY EXPOSURE TO KRAFT PULP MILL EFFLUENT ON THE BLOOD AND TISSUES OF JUVENILE COHO SALMON (Oncorhynchus kisutch). J. Fish. Res. Bd. Canada, 30(3): 395-400.

Red blood cell counts and hematocrits of juvenile coho salmon were unaltered by 12-hr exposure to neutralized kraft pulp mill effluent, although hematocrits were decreased by exposure for 25 days. The number of circulating immature erythrocytes increased in effluent-exposed fish in both the 12-hr and 25-day exposures. The number of circulating small lymphocytes decreased markedly after 12-hr exposure. However, following the prolonged exposure, the number of small lymphocytes returned to normal, while the number of circulating neutrophils increased. The level of plasma glucose increased in fish exposed to effluent for 12 hr, and decreased in fish exposed for 25 days. Liver glycogen was not altered significantly during either exposure period. No pathological changes attributable to exposure to kraft pulp mill effluent were observed in the tissues examined, including the spleen, kidney, gill, interrenal gland, skin epithelium, and thyroid gland. Results are discussed in terms of a stress response. (Auth.)

16439. Love, Milton S., and John Vucci. 1973. PARTIAL AMBICOLORATION IN THREE CALIFORNIA FLATFISHES. Calif. Fish and Game, 59(2): 146-148.

Ambicoloration is reported and described for Citharichthys xanthostigma, Xystreurys liolepis and Pleuronichthys coenosus. These fish were collected near Santa Barbara.

16440. Hastings, Robert W. (Dept. of Biol. Sci., Fla. State Univ., Tallahassee, Florida 32306). 1973. BIOLOGY OF THE PYGMY SEA BASS, Serraniculus pumilio (PISCES: SERRANIDAE). NOAA Fishery Bull., 71(1): 235-242.

During the period from 1968 to 1971, numerous specimens of Serraniculus pumilio, were collected in shallow waters of the northern Gulf of Mexico. This paper presents biological data accumulated from these and other specimens in the fish collection of Florida State University and from scattered literature references regarding the species. The range of S. pumilio extends from North Carolina along the continental margin of the western Atlantic Ocean to Guyana, but it apparently does not occur in the West Indies. It has been collected at depths from 1 to 117 m, usually over sand or shell bottoms near coral or rock reefs or accumulations of mollusk shells. Individuals move about considerably, although they spend much time resting on the bottom. S. pumilio is a synchronous hermaphrodite, but pairs mate to exchange gametes and self-fertilization probably never occurs. Spawning occurs between March and August or September in the northern Gulf of Mexico. A length-frequency distribution of specimens collected in the northern Gulf is presented to show the growth rate of a first year fish. Juveniles (15-20 mm SL) which appear inshore in September reach a size of 50-55 mm by the following June. Most fish move offshore to deeper water for the winter (January and February) and individuals larger than 55 mm apparently never appear inshore. Small crustaceans are the most important food items. (Auth.)

16441. Horoszewicz, Lidia (Inland Fish. Inst., Zabieniec, Warsaw, Poland). 1973. LETHAL AND 'DISTURBING' TEMPERATURES IN SOME FISH SPECIES FROM LAKES WITH NORMAL AND ARTIFICIALLY ELEVATED TEMPERATURE. J. Fish Biol., 5(2): 165-181.

The mean lethal temperatures and 'disturbing' temperatures of 14 species of freshwater fish have been determined in field tests carried out on lakes unheated and heated by power stations near Konin. The relationships between these parameters and the acclimation temperatures of fish in these lakes are analysed in relation to roach Rutilus rutilus (L.), rudd Scardinius erythrophthalmus (L.) and perch Perca fluviatilis (L.) and compared with the other published data for these species. (Auth.)

16442. Lake Michigan Interstate Pesticides Committee. 1972. AN EVALUATION OF DDT AND DIELDRIN IN LAKE MICHIGAN. Copy available from GPO Sup Doc as EP 1.23:72-003, $1.25; microfiche from NTIS as PB-214 696 $0.95. Environ. Protection Agency, Ecological Research Series, EPA-R3-72-003, 139 p., 4 fig, 34 tab, 39 ref, 8 append.; Selected Water Resources Abstracts, 6(9): p. 53.

An investigational program was designed to provide information essential to evaluate the impact of pesticides on Lake Michigan. Data were collected from waters, wastewaters, invertebrate organisms, and fish; analysis of samples from open water for the purpose of developing general residue levels was impractical. Biological accumulation potential is greater in inshore waters since most of the important biological representatives spend extended periods of time within these areas. Tributary streams to Lake Michigan discharge chlorinated hydrocarbon pesticides into the lake; urban and fruit-growing areas are the more significant contributors of pesticides than are diversified agricultural areas. The polychlorinated biphenyls are present in sufficient quantity, with sufficient evidence of biological impact, to warrant independent evaluation. Resident fish appear to be the most reliable biological monitor. The biological magnification of chlorinated hydrocarbon insecticides in sport and commercially valuable fish species suggests that fish should be used to reflect concentration trends. Effect of the pesticides in Lake Michigan on fish reproduction potential is not yet resolved. The pesticides, through biological magnification, may have a potential effect on both domestic and wild animals that eat fish or other organisms from the lake.

16443. Kulow, H. (Director, Fischgesundheitsdienstes der DDR, Berlin-Friedrichshagen, Berlin, Germany). 1972. REVIEW OF INFORMATION PRESENTED DURING A SYMPOSIUM ON DISEASES OF FISHES IN THE SOVIET UNION. (Ergebnisse des I. Allunionssymposiums über infektiöse Fischkrankheiten in der UdSSR). Zeit. f. Binnenfischerei der DDR XIX: 361-384; Fish Health News, 2(2): p. 12.

A conference on diseases of fishes in the Soviet Union was held in Moscow on May 16-19, 1972. Fifty-three papers were presented on diseases prevailing in the Soviet Union and on methods of their control. The most important diseases are infectious dropsy, inflammation of gas bladder, gill necrosis, septicaemias caused by pseudomonads, an infectious disease of grass carp, and viral infection of cyprinids. Other papers were presented on prophylaxis and therapy with Monomyzin, Neomycin, Kormosin, Biovit 80, Dibiomyzin, Methylene blue, Furazolidon, immunization and selection and breeding for resistance. Plans for future work were outlined. -- S. F. Snieszko

16444. Locascio, Nicholas J. T., and James E. Wright, Jr. (Dept. of Biol., Buffalo State Univ. College, 1300 Elmwood Ave., Buffalo, New York 14222). 1973. A STUDY OF ACHROMATIC REGIONS IN SPECIES OF SALMONIDAE AND ESOCIDAE. Comp. Biochem. Physiol., 45(1B): 13-16.

An oxidase found in achromatic regions on tetrazolium stained gels is described electrophoretically from various species of trout. The enzyme was stained with and without the use of the substrate G-6-P or 6-PG. The results indicate that the enzyme is apparently a dimer as a 1:1 ratio of triple : single banded specimens was obtained from sibling lots of rainbow and brown trout. The enzyme appears to be autosomally inherited as no association between sex and single or triple bands was observed. (Authors)

16445. Maggenti, A. R. (Dept. of Nematol., Univ. of Calif., Davis, California). 1973. ANTHELMINTICS FOR NEMATODE PARASITES OF FISH: II. AQUEOUS ANTHELMINTIC BATH TREATMENTS USING DIETHYL 2-CHLOROVINYL PHOSPHATE AND 2,2 DICHLOROVINYL DIMETHYL PHOSPHATE FOR CONTROL OF Sterliadochona pedispicula IN Salmo gairdnerii. Proc. Helm. Soc. Wash., 40(1): 97-101.

The toxicity of diethyl 2-chlorovinyl phosphate (SD1836) and 2,2 dichlorovinyl dimethyl phosphate (DDVP) was tested as an "in-water" treatment of rainbow trout and in vitro against the internal nematode parasite of fish, Sterliadochona pedispicula. As an "in-water" anthelmintic treatment SD1836 was 100% effective at concentrations of 25μ liters/liter for 24 hr and 5μ liters/liter for 72 hr; no toxic effects to rainbow trout were noted with these treatments. (Auth.)

16446. Künnemann, H. (Zool. Inst. der Univ. Kiel, Kiel, Germany). 1973. RESISTANCE ADAPTATION DURING INHIBITED PROTEINBIOSYNTHESIS. EXPERIMENTS WITH ACTINOMYCIN D IN THE FISH Rhodeus amarus (Resistenzadaptation bei gehemmter Proteinbiosynthese. Versuche mit Actinomycin D auf dem Fisch Rhodeus amarus). Marine Biology, 18(4): 260-271. In German with English abstract.

Rhodeus amarus acclimated to 10° or 20°C die at 31.7° or 36.4°C respectively (cessation of operculum movements). After raising the adaptation temperature (AT) from 10° to 20°C, adaptation is complete after 8 days. The toxicity of actinomycin D, injected intraperitoneally, is AT-dependent (e.g. at 5°C, LD_{50}-7 days = 0.8 μg/g fish; at 25°C, LD_{50} - 7 days = 0.35 μg/g fish). In the following experiments 0.5 μg actinomycin/g fish were used. After actinomycin-injection, RNA-values in white dorsal muscle decreased about 50% within 12 h and the values of control individuals were finally attained after 16 days. Following an AT-change from 10° to 20°C, DNA-values in the white dorsal muscle increased about 10%, RNA values about 30°, within 12 h. However, in fish injected intraperitoneally with actinomycin, no increase in DNA or RNA was noticed. Actinomycin injection per se causes increased heat resistance. This process lasts 10 days. If AT is raised now from 10° to 20°C, the new resistance level is reached later. The control fish gain resistance at a rate of about 1°C/day during the first days after the temperature change. Actinomycin-treated individuals, however, exhibit increase of 0.25°C/day. Inhibition of resistance adaptation due to proteinbiosynthesis inhibitors supports the view that protein synthesis is of importance for adjustments in heat resistance of intact animals. (Auth.)

16447. Žitňan, R. 1970. RAPHIDASCAROSIS A SEVERE PARASITARY DISEASE OF TROUTS IN CZECHOSLOVAKIA. (Rafidaskaróza - závažná parazitárna choroba našich pstruhov). Polov. a Ryb., 22(6): p. 4; Agric. Literature of Czechoslovakia, No. 3-4, Abs. No. 816, p. 176, 1971.

In the locality of the Dobsina Dam, an important parasite of Czechoslovak fish - nematode Raphidascaris ocus - is considerably spread. The parasite is a threat to brown trout, lake trout, rainbow trout as well as to fish living in lowland waters, particularly pikes and eels. The sexually mature parasites live in the digestive tracts of the hosts where they produce eggs which get into water with excrements and gradually sink to the bottom. The eggs or larvae are consumed by fish and other water organisms. The larvae penetrate through the wall of the digestive tract into the body cavity and undergo further development in the so-called invasion larvae. If such a fish with the invasion larvae is consumed by trout, the parasite finished its development in the trout's digestive tract, produces eggs, and the whole life cycle is repeated.

16448. Ivanov, S. N. (All-Union Res. Inst. of Pond Fisheries, Kiev, USSR). 1972. INTRODUCTION OF MYSIDS INTO PONDS AS A MEANS OF INCREASING FISH PRODUCTIVITY. Hydrobiological Journal, 8(1): 24-30.

Experiments with the introduction of mysids into fish ponds drained every year showed that they can survive at a high density of fish stocking. Their numbers increase substantially in a single summer. Mysids can be introduced through main or distributing ponds, the rate of increase is proportional to the original density of stocking a given pond. M. kowalevskyi and L. benedeni caught in the Arakumian freshwater lakes and transferred to our ponds can tolerate an increase in water temperature to 28.8° and oxygen content of 1.9 mg/liter. The introduction of mysids into ponds increased the fish productivity by 150 to 200 kg/ha. (Auth. conclusions)

16449. Nissinen, Toivo. 1972. THE EGG DENSITY AND THE SURVIVAL OF EGGS ON THE SPAWNING GROUNDS OF THE VENDACE (Coregonus albula L.) IN LAKES PURUVESI AND OULUJÄRVI (Mätitiheys ja mädin eloonjääminen muikun (Coregonus albula L.) kutupaikoilla Puruvedessä ja Oulujärvessä). Riista- ja Kalatalouden Tutkimuslaitoksen Kalantutkimusosaston Tiedonantoja, 1(1): 114 p. In Finnish with English summary.

16450. Ihssen, Peter (Dept. of Zool., Univ. of Toronto, Toronto, Ontario, Canada). 1973. INHERITANCE OF THERMAL RESISTANCE IN HYBRIDS OF Salvelinus fontinalis AND S. namaycush. J. Fish. Res. Bd. Canada, 30(3): 401-408.

The two reciprocal F_1 hybrids of brook trout (Salvelinus fontinalis) and lake trout (S. namaycush) had similar times to death on exposure to several lethal high temperatures for a series of acclimation temperatures. These hybrids resembled the brook trout, the more resistant parent, more than the lake trout. The F_2 hybrids were intermediate in resistance to the parent species, and the backcrosses intermediate between the F_2 hybrids and the respective parents. After acclimation to 5 and 10 C, F_2's and backcrosses arising from the F_1 hybrid of brook trout maternal origin were consistently higher in resistance than the F_2 and backcrosses arising from the F_1 hybrid of lake trout maternal origin. After acclimation to 20 C and above, differences associated with the maternal origin of the F_1 hybrid were not found. The number of effective factors segregating was estimated using the techniques of variance component analysis. A genetic model with two codominant factors was found to fit the data for 5 and 10 C acclimation, and one with five factors and dominance of the brook trout factors was found to fit the data for the higher acclimation temperatures. (Auth.)

16451. Pennell, David A., C. Dale Becker, and Nora R. Scofield (Fish. Res. Inst., College of Fisheries, Univ. of Wash., Seattle, Washington 98105). 1973. HELMINTHS OF SOCKEYE SALMON (Oncorhynchus nerka) FROM THE KVICHAK RIVER SYSTEM, BRISTOL BAY, ALASKA. NOAA Fishery Bull., 71(1): 267-277.

A study of helminths infecting juvenile and adult sockeye salmon (Oncorhynchus nerka) leaving and entering the Kvichak River system, Bristol Bay, Alaska, was conducted in 1969. Ten helminths acquired in fresh water were found in smolts: Diplostomulum sp.; an unidentified trematode; Diphyllobothrium spp.; Triaenophorus crassus Forel, 1868; Proteocephalus sp.; Eubothrium salvelini (Schrank, 1790); Neoechinorhynchus rutili (Mueller, 1789); Philonema oncorhynchi Kuitunen-Ekbaum, 1933; Rhabdochona sp.; and Contracaecum sp. In addition to surviving larval stages of freshwater parasites, adults were infected by nine helminths acquired in the sea: Gyrodactyloides strelkowi Bykhovskaya and Polyanskaya, 1953; Lecithaster gibbosus (Rud., 1802); Brachyphallus crenatus (Rud., 1802); Tubulovesicula lindbergi (Layman, 1930); Phyllobothrium caudatum (Zschokke and Heitz, 1914); Echinorhynchus gadi Mueller, 1776; Bolbosoma caenoforme Heitz, 1920; Anisakis sp.; and Contracaecum sp. Infection incidences and intensities are tabulated where accurate data are available. Information on life histories is assembled from scattered sources, and some ecological aspects of helminths infecting Kvichak sockeye salmon are briefly discussed. (Authors)

16452. Krygier, Earl E., William C. Johnson, and Carl E. Bond. 1973. RECORDS OF THE CALIFORNIA TONGUEFISH, THREADFIN SHAD AND SMOOTH ALLIGATORFISH FROM YAQUINA BAY, OREGON. Calif. Fish and Game, 59(2): 140-142.

These records extend the known northward range of Symphurus atricauda and Dorosoma petenense. The range of Anoplagonus inermis is extended southerly.

16453. Hamor, T., and E. T. Garside (Dept. of Biol., Dalhousie Univ., Halifax, Nova Scotia, Canada). 1973. PEROXISOME-LIKE VESICLES AND OXIDATIVE ACTIVITY IN THE ZONA RADIATA AND YOLK OF THE OVUM OF THE ATLANTIC SALMON (Salmo salar L.). Comp. Biochem. Physiol., 45(1B): 147-151.

Isolated zona radiata and isolated yolk of fertilized ova of Atlantic salmon (Salmo salar L.) consumed dissolved oxygen in Warburg manometric respirometers at highly variable rates of which 25 and 66 μg/g per hr are representative for zona at 5 and 10°C, and 75 and 33 μg/g per hr are representative for yolk at 5 and 10°C. Zona radiata consumed dissolved oxygen in improvised continuous-flow respirometers at approximately 130 μg/g per hr at 5°C. Peroxisome-like vesicles containing oxidative enzymes were demonstrated histochemically in both zona radiata and yolk. (Authors)

16454. Rafail, S. Z. (Inst. of Oceanogr. and Fish., Kayed Bey, Alexandria, Egypt). 1972. THE APPLICATION OF A MULTIPLE-RECAPTURE TECHNIQUE FOR THE STUDY OF SOME ASPECTS OF DYNAMICS OF LARGE FISH POPULATIONS. Marine Biology, 17(3): 251-255.

The multiple-recapture technique can be used to study some aspects of the dynamics of large fish populations, if a part of the fishing fleet is considered as experimental fishing boats by appointing observers to release tagged fish which are captured, while untagged fish captured are retained. The tagged and untagged populations are assumed to have different properties such as catchability and survival rates. The fish are sampled during a number of sampling surveys with equal duration and no intervening time intervals between them. It is assumed that fish suffer from mortalities during sampling surveys. The parameters of untagged populations can be estimated with the help of the readily estimated parameters of tagged fish (Rafail, 1972), the relationship between the parameters of tagged and untagged populations, and the numbers of untagged fish captured during the sampling surveys. The estimates are free from Types A and B tagging errors. (Auth.)

16455. Hill, Loren G., Gary D. Schnell, and Anthony A. Echelle (Dept. of Zool., Univ. of Oklahoma, Norman, Okla.). 1973. EFFECT OF DISSOLVED OXYGEN CONCENTRATION ON LOCOMOTORY REACTIONS OF THE SPOTTED GAR, Lepisosteus oculatus (PISCES: LEPISOSTEIDAE). Copeia No. 1, pp. 119-124.

Spotted gar, Lepisosteus oculatus, not provided with an aerial source of oxygen selected oxygen concentrations in their external aquatic medium that indicated a preferred zone of operation; this effect was heightened at elevated temperatures. Locomotory reactions of gar provided with an atmosphere were largely unaffected by the oxygen concentration of their surroundings; however, some evidence suggested that, at elevated temperatures, they were not wholly unresponsive to oxygen concentrations of the environment. (Authors)

16456. Odense, P. H., V. H. Logan, and S. R. Baker (Fish. Res. Bd. Canada, Halifax Lab., Halifax, Nova Scotia, Canada). 1973. SPONTANEOUS NEPHROBLASTOMA IN A RAINBOW TROUT (Salmo gairdneri). J. Fish. Res. Bd. Canada, 30(4): 549-551.

A neoplasm in a rainbow trout (Salmo gairdneri) identified as a nephroblastoma is described and its possible pathological implications discussed. The characteristic conditions of abortive renal tubules and glomeruli in a fibrous stroma were observed; however, metastases were absent. The simultaneous presence of inflammatory kidney disease made association of clinical signs with the neoplasm impossible. This is the first case of nephroblastoma in Canadian hatchery stock. The etiological factors are unknown. (Authors)

16457. Soin, S. G., and A. I. Sukhanova (Dept. of Ichthyol., Moscow Univ. and Inst. of Zool., Turkmenian Academy of Sciences, USSR). 1972. COMPARATIVE MORPHOLOGICAL ANALYSIS OF THE DEVELOPMENT OF THE GRASS CARP, THE BLACK CARP, THE SILVER CARP AND THE BIGHEAD (CYPRINIDAE). J. Ichthyol., 12(1): 61-71.

An account is given of general and specific structural features in the development of embryos, larvae and fingerlings of the grass carp and the black carp, the silver carp and the bighead, which are now being extensively acclimatized in inland waters in our country. It has been established that, as pelagophilous fish, all these species are characterized by early hatching from the egg, by weak development of the embryonic respiratory organs, by the late appearance of pigment, and by accelerated passage through the development stages. In addition, a number of significant differences have been established in their development relating to the size of the eggs and embryos, the number of myotomes, the nature and degree of pigmentation, the proportions in development of the jaws, the location of the unpaired fins, the development of the keel and the scales and also a number of other characters. The differences established are important for identification of the species of these fish in the early stages of ontogeny when carrying out acclimatization operations.

16458. Noble, Richard L. (Dept. of Nat. Res., Cornell Univ., Ithaca, New York). 1972. DISTRIBUTION OF WALLEYE AND YELLOW PERCH FRY IN A BAY OF ONEIDA LAKE. N. Y. Fish and Game Journal, 19(2): 168-177.

Densities of walleye and yellow perch fry were usually greater inshore than offshore in samples taken during early June. Walleye fry concentrated at a variable depth, whereas yellow perch fry were uniformly distributed to a depth of 3.7 meters except during calm weather. Although vertical and horizontal distributions of the two species did not coincide, catches were correlated within localized areas. Correlations between the abundance of yellow perch fry and their occurrence in walleye fry stomachs indicated that the association between the two species may have been caused by a predator-prey relationship. The over-all difference in distribution indicated that perch abundance was not the major influence on the distribution of walleye fry. (Auth.)

16459. Miller, John (Univ. of Hawaii, Hawaii Inst. of Mar. Biol., Coconut Island, Kaneohe, Hawaii). 1973. A QUANTITATIVE PUSH-NET SYSTEM FOR TRANSECT STUDIES OF LARVAL FISH AND MACROZOOPLANKTON. Limnol. and Oceanogr., 18(1): 175-178.

A surface plankton sampler that quantitatively samples contiguous segments of a transect has characteristics that include operability in shallow water by two investigators, paired, self-cleaning nets, a minimum of obstructions preceding the nets, and a high ratio of filtering area to mouth area. (Auth.)

16460. Knight, L. A., Jr., and J. Herring (Dept. of Biol., Mississippi Univ., State College, Mississippi). 1972. TOTAL MERCURY IN LARGEMOUTH BASS (Micropterus salmoides) IN ROSS BARNETT RESERVOIR, MISSISSIPPI - 1970 AND 1971. Pesticides Monitoring Journal, 6(2): 103-106; Selected Water Resources Abstracts, 6(10): p. 39.

Total mercury in 73 largemouth bass, Micropterus salmoides, from Ross Barnett Reservoir, Mississippi, was measured by atomic absorption spectrophotometry. Samples of flesh from the trunk region below the dorsal fin and above the lateral line were mechanically chopped and mixed in a blender and subsamples were dissolved in a mixture of concentrated nitric and sulfuric acids and diluted with distilled water. After cooling the sample to room temperature, an aliquot was reduced using 10 percent stannous sulfate and placed in the absorption system. Standards were run similarly. The fish analyzed were collected between November 1970 and October 1971, at intervals representing winter, spring, summer, and fall; specimens ranged in weight from 0.10 to 3.15 kg. Fish contained from less than 0.05 to 0.74 ppm total mercury; levels generally increased with weight of the fish.

16461. Eckroat, Larry R. (Dept. of Biol., The Behrend Coll. of the Pa. State Univ., Erie, Pennsylvania 16510). 1973. ALLELE FREQUENCY ANALYSIS OF FIVE SOLUBLE PROTEIN LOCI IN BROOK TROUT, Salvelinus fontinalis (Mitchill). Trans. Amer. Fish. Soc., 102(2): 335-340.

Phenotypes for five soluble protein loci (serum transferrin, lactate dehydrogenase, and three eye lens proteins) in native brook trout, Salvelinus fontinalis (Mitchill), were determined by either acrylamide or starch gel electrophoresis. An allele frequency analysis involving these five loci was performed and the resultant allele frequencies were compared (chi-square of contingency) with results of a similar study conducted on samples from the same streams in 1966. All intra-stream, inter-year heterogeneities of the serum transferrin allele frequencies were found to be statistically insignificant. Intra-stream, inter-year heterogeneities of the three lens protein loci were statistically insignificant except for one population. In this one population the dominant allele (LP_5) had become fixed, which seems to be the most frequent condition in natural populations. Determination of phenotypes and calculation of allele frequencies at the LDH-B locus indicated that certain heterozygous genotypes cannot be distinguished with lens protein homogenates; however, these genotypes can be discerned with the use of whole stream and inter-year heterogeneities were found to be insignificant. Thus, indications are that allele frequencies at these five loci have remained fairly stable over a 4-year period in the five brook trout populations studied. (Auth.)

16462. Egglishaw, Henry J., and P. E. Shackley (Freshwater Fish. Lab., Pitlochry, Perthshire, Scotland). 1973. AN EXPERIMENT ON FASTER GROWTH OF SALMON Salmo salar (L.) IN A SCOTTISH STREAM. J. Fish Biol., 5(2): 197-204.

The experiment was made in an attempt to modify the usual relationship in which young trout grow faster than young salmon in streams in which they occur together. A stretch of a trout stream was stocked with advanced salmon eggs, which produced fry earlier than the trout eggs laid naturally. The salmon grew faster than the trout and were longer than the trout at the end of the growing season. The mean length of 77.7 mm attained by the salmon is the largest known size reached by salmon in their first year when feeding on natural food supplies in streams in Scotland. Survival rate from egg planting to production of salmon of this mean length was high. (Authors)

16463. Befus, A. D., and R. S. Freeman (Depts. of Parasitol. and Zool., Univ. of Toronto, Toronto, Ontario, Canada). 1973. LIFE CYCLES OF TWO CORALLOBOTHRIIN CESTODES (PROTEOCEPHALOIDEA) FROM ALGONQUIN PARK, ONTARIO. Can. J. Zool., 51(2): 249-257.

Corallobothrium parafimbriatum and Corallotaenia minutia infected bullheads in all lakes sampled but Billy Lake, where only C. parafimbriatum occurred. Plerocercoids and maturing worms are in the gut of bullheads throughout the year although gravid adults occur only during during the summer in potentially reproductive bullheads. Fully differentiated plerocercoids of C. parafimbriatum grew in Cyclops bicuspidatus, C. vernalis, Tropocyclops prasinus, and an immature cyclopoid; C. minutia developed in C. vernalis. C. parafimbriatum required 21 days at 18C for growth, differentiation, and invagination or retraction of the scolex, and C. minutia required 39 days at 18C. After initial development in a copepod, plerocercoid I of C. minutia requires parenteral development in a fish, whereas plerocercoid I of C. parafimbriatum does not. Parenteral plerocercoids of C. minutia, Proteocephalus ambloplitis, and dead metacestodes were common in bullheads. As with other proteocephalids, corallobothriin plerocercoid I develops to plerocercoid II in fish. Plerocercoid I from copepods may enter the viscera, but unlike P. ambloplitis and Ophiotaenia filaroides the end organ atrophies. In the gut of the definitive host plerocercoid II increases in size and develops a metascolex and modified protonephridial system, before adult development ensues. (Authors)

16464. Ballard, William W. (Biol. Dept., Dartmouth, College, Hanover, New Hampshire). 1973. MORPHOGENETIC MOVEMENTS IN Salmo gairdneri Richardson. J. Exp. Zool., 184(1): 27-48.

Uncoordinated movements of individual internal blastomeres of the pregastrular blastodisc are distinguished from true morphogenetic movements which later segregate the germ layers and establish the embryonic axis and its organs. These coordinated movements are described in detail for stages 7 through 10 on the basis of recorded drift of chalk dust implanted among the blastomeres, and of vital dye spots printed on the blastodisc. The movements of the chalk and of the living colored cells follow the same pattern but the chalk gives more precise information over a longer time span. There is no evidence of invagination, or in-wheeling, or centripetal convergence. Most of the movements combine epiboly and convergence, but in different proportions varying with the depth of the cells and their distance from the blastodisc center. A line of chalk dust, implanted by needle thrust down the full depth of the blastodisc often divides into a superficial, chiefly epibolic, cloud of granules and a deeper one, convergent toward the axis. Particles from a single implantation site may become incorporated into a variety of organs and tissues, indicating that a fate map for Salmo must be three-dimensional. The forebrain receives secondary contributions from the center of the blastodisc. Movements directly comparable to closure of neural folds are described during formation of the brain. The role of the germ ring is examined in detail. It does contribute to the mesoderm of the tail. Migration along it toward the axis involves only the hypoblast, through which cells move at very different rates. (Auth.)

16465. Kulikov, N. V., V. G. Kulikova, and S. A. Lyubimova (Sverdlovsk. Inst. of Plant and Animal Ecology, Akademiya Nauk SSSR). 1971. EXCRETION OF STRONTIUM 90 AND CESIUM 137 WITH FISH EGGS DURING SPAWNING. Ekologiya, 2(4): 12-16, illus., in Russian; Selected Water Resources Abstracts, 6(9): p. 54.

A quantitative determination is presented of the excretion of Sr90, Cs137, Ca, Mn, and K from female tench (Tinca tinca) and pike (Esox lucius) with their eggs during spawning under natural conditions. The coefficients of discrimination of Sr90 relative to Ca and Mg and of Cs137 relative to K upon uptake of these elements from the aquatic environment into the fishes and their excretion from the fishes with eggs are presented. -- Biological Abstracts, Inc.

16466. Karasik, V. M., Yu. N. Krivenko, and I. I. Stovbun (Inst. of Hydrobiol., Ukr. Acad. of Sci., Kiev, USSR). 1972. STUDY OF THE OPERATION OF WATER AERATORS. Hydrobiological Journal, 8(1): 45-48.

This article reports briefly on the results of laboratory and field tests of the bubbler and ejector methods of aerating water started in 1970.

16467. Streifer, William (Dept. of Elec. Eng., Univ. of Rochester, Rochester, New York). 1973. A CRITICAL VARIABLE FORMULATION OF POPULATION DYNAMICS. Ecology, 54(2): 392-398.

A single-species population model which admits a more realistic and complete description of the internal structure and changes of a population as well as a more complete description of the external influences gathered about the population is presented. The basic idea is to identify the characteristics which most critically affect the population dynamics. Coupled differential equations for the total population and the means and variances of the critical variables, such as age and mass, are formulated. Thus the means and variances of the critical variables change with time. After the derivation of the equations an example is given. The example illustrates that the behavior of the population and its equilibrium depend on quantities which have ecological significance. (Auth.)

16468. Gruchy, I. M., and Don E. McAllister (Canadian Wildl. Service, Ottawa, Canada). 1972. A BIBLIOGRAPHY OF THE SMELT FAMILY, OSMERIDAE. Fish. Res. Bd. Canada Tech. Report No. 368 (Manuscript status), 104 p.

This bibliography includes approximately 1800 titles from the year 1553 to 1971. Papers were added to the manuscript up to the cutoff date, 1 October, 1972. While probably not complete, the bibliography does contain the majority of important papers on the group. Books or papers with only a line or two on smelts and catch statistics have not generally been included; these are the only categories of publication intentionally excluded. (Auth. introduction)

16469. Stott, B., and D. G. Gross (Salmon and Freshwater Fish. Lab., Min. of Agric., Fish., and Food, London, England). 1973. THE REACTIONS OF ROACH [Rutilus rutilus (L.)] TO CHANGES IN THE CONCENTRATION OF DISSOLVED OXYGEN AND FREE CARBON DIOXIDE IN A LABORATORY CHANNEL. Water Research, 7(5): 793-805.

Roach can be trained to accept part of a laboratory channel as a home range to which they return if artificially displaced. Falling concentrations of dissolved oxygen in the channel cause roach to move downstream to better oxygenated water by means of a predominantly appropriate response. When an aerated water flow was restored the fish quickly reoccupied their original position. Fish newly introduced into the channel responded in a similar manner except that they did not return to the original position. Roach acclimated to a reduced level of dissolved oxygen needed a rather lower oxygen level to cause the downstream movement. An increase in the amount of free carbon dioxide together with a reduction in oxygen content induced fish to respond to higher levels of oxygen than if the oxygen only was reduced. It is suggested that the use of conditioned fish in laboratory channels may be a useful technique in studying avoidance reactions. (Authors' conclusions)

16470. Tuunainen, Pekka, Kaj Granberg, Lasse Hakkari, and Jukka Särkkä. 1972. ON THE EFFECTS OF EUTROPHICATION ON LAKE PÄIJÄNNE, CENTRAL FINLAND. Verh. Internat. Verein. Limnol., 18: 388-402.

Lake Päijänne (1090 km^2) is the second largest lake of Finland. Because of its position near the population and industrial centers of southern Finland a demand to protect this great water basin against pollution has been awakened. In future, Lake Päijänne will serve as a water source for the city of Helsinki and for the population and industry of southern Finland. In the Hydrobiological Research Institute, Jyväskylä, investigations have been carried out since 1968 to illustrate the water quality of the lake and the importance of the lake for professional and non-professional fishery. The following report is an attempt to describe the reactions of an aquatic biocoenose as different kinds of waste waters are discharged into an oligotrophic and oligohumic lake.

16471. Conover, R. J., and V. Francis (Fish. Res. Bd. of Canada, Mar. Ecol. Lab., Bedford Inst., Dartmouth, Nova Scotia, Canada). 1973. THE USE OF RADIOACTIVE ISOTOPES TO MEASURE THE TRANSFER OF MATERIALS IN AQUATIC FOOD CHAINS. Marine Biology, 18(4): 272-283.

Radioisotopes have been misused extensively by ecologists in transfer studies within food chains. Unless it is known that no recycling of isotope has occurred during the experiment, the assumption of linear uptake when in fact the system is not linear, even over short periods, can lead to significant errors in the estimation of ingestion or feeding. If recycling occurs, at least a 3 or 4-compartment, hydraulic-type model is necessary to even approximate the complicated kinetics of isotopic transfer in a simple aquatic feeding experiment. In any event, it is essential to follow the uptake or loss of an isotope (change in specific activity) as a function of time in at least 1 compartment before deciding on an appropriate model. If experiments are designed so that the maximum number of rate processes are summed or integrated by the animal, the kinetics can be considerably simplified. If the food supply is uniformly labelled, the rate of change of tracer can be used to give a rate of ingestion (grazing). If the predator is labelled with a suitable isotope before starting the experiment, the rate of loss of its isotope burden under different experimental conditions can be used to determine respiration or excretion rates, turnover rates, ingestion, and the size and number of major compartments in the transfer system. (Authors)

16472. Stirling, Hadrian P. (Dept. of Oceanogr., Univ. of Southampton, England). 1972. THE PROXIMATE COMPOSITION OF THE EUROPEAN BASS, Dicentrarchus labrax (L.) FROM THE BAY OF NAPLES. Journal du Conseil, 34(3): 357-364.

Analytical methods were developed for determining non-protein nitrogen and carbohydrate in addition to moisture, ash, lipid and protein in the white muscle, dark muscle, liver and gonads of European bass from the Bay of Naples. There was little variation in the composition of the white muscle in contrast to the variability of the other tissues, which could in many cases be related to the nutritional state or stage of sexual maturity of the fish. The general conclusion on the proximate composition of the fish is in agreement with previous work, i.e. the white muscle has a high food value, being rich in protein and low in lipid. (Auth.)

16473. Law, Y. M. C., and J. G. Eales (Dept. of Zool., Univ. of Manitoba, Winnipeg, Manitoba, Canada). 1973. DEIODINATION OF RADIOTHYROXINE BY TISSUE HOMOGENATES OF BROOK TROUT, Salvelinus fontinalis (Mitchill) Comp. Biochem. Physiol., 44(4B): 1175-1183.

Brook trout tissue homogenates were incubated with radiothyroxine (labelled with ^{125}I in the phenol ring) at previous fish acclimation temperature (12-14°C) for up to 3 hr. Deiodination (measured by the production of radioiodide using protein precipitation by trichloroacetic acid and chromatography) occurred in brain, gill, stomach, duodenum, intestine, heart, kidney and muscle but not in liver. Radioiodide was the only identifiable radioactive deiodination product. A thermostable deiodinating system was present in brain and heart. (Authors)

16474. Petrosky, Bernard R., and John J. Magnuson (Ichthyological Associates, Middletown, Delaware). 1973. BEHAVIORAL RESPONSES OF NORTHERN PIKE, YELLOW PERCH AND BLUEGILL TO OXYGEN CONCENTRATIONS UNDER SIMULATED WINTERKILL CONDITIONS. Copeia No. 1, 124-133.

Northern pike (Esox lucius), yellow perch (Perca flavescens), and bluegill (Lepomis macrochirus), were exposed to successively lower oxygen concentrations (4.0, 2.0, 1.0, 0.5, and 0.25 mg/liter) each day for five days in aquaria sealed above with simulated "ice." Water temperature varied from 2.5 to 4.0 C and light intensity and photoperiod simulated conditions in an ice-covered lake. Gill ventilation rates increased in response to lowered oxygen, doubling for bluegill and yellow perch but quadrupling for northern pike. Maximum ventilation rates occurred at 0.5 mg/liter D.O. for northern pike and yellow perch and at 1.0 mg/liter D.O. for bluegill. Locomotory activity was greatest at 0.25 mg/liter D.O. for northern pike but at 0.5 mg/liter D.O. for yellow perch and bluegill. Northern pike and yellow perch began to move toward the ice at 0.5 mg/liter D.O. At 1.0 mg/liter D.O., bluegill kept sinking to the bottom of the aquaria; they continually made forays upward only to sink again. Northern pike and yellow perch nosed at the under surface of the ice at the lowest oxygen concentrations while bluegill seldom did. The fish never aggregated more than 10 percent of the time even at the lowest concentrations of dissolved oxygen. Almost all northern pike and yellow perch were still alive at 0.25 mg/liter D.O. while all bluegill were dead. Evidently northern pike are best adapted for survival in winterkill lakes and bluegill the least. The upward movement takes the fish to the highest oxygen available in the immediate vicinity. Detection of an oxygen gradient is not a requirement of this response because in the aquaria the fish move to the ice at low oxygen concentrations in absence of a gradient. High free CO_2 and dissolved H_2S are also not necessary to stimulate or orient the upward movement. Increased locomotory activity, if coupled to reduced activity when respiratory distress is alleviated, also provides an effective mechanism for locating higher oxygen. The increases in gill ventilation have obvious survival value. (Authors)

16475. Schaefer, Richard H. (N. Y. State Dept. of Environ. Conservation, New York). 1972. A SHORT-RANGE FORECAST FUNCTION FOR PREDICTING THE RELATIVE ABUNDANCE OF STRIPED BASS IN LONG ISLAND WATERS. N. Y. Fish and Game Journal, 19(2): 179-181.

Observations have led some authors to suggest that a definable relationship exists between Chesapeake Bay production and subsequent coastal harvest, but such a relationship has been neither formulated nor described in detail. Using brood production data for the Maryland waters of Chesapeake Bay and commercial landings data from New York, the author has attempted to provide a short-range forecast function for predicting the relative abundance of striped bass in Long Island waters.

16476. Schreck, Carl B., Robert T. Lackey, and M. Lloyd Hopwood (Colo. Coop. Fish. Unit, Colo. State Univ., Fort Collins, Colorado 80521). 1973. PLASMA OESTROGEN LEVELS IN RAINBOW TROUT Salmo gairdneri Richardson. J. Fish Biol., 5(2): 227-230.

Levels of oestrogens in plasma of mature fall-spawning rainbow trout Salmo gairdneri were determined using a radio-immunoassay. No significant difference was found in oestrogen concentration between the sexes (male $\bar{x}$ = 2.5 ng/ml; female $\bar{x}$ = 4.4 ng/ml); between individual variability was great. Four blood samplings over a 24-h period via cardiac puncture of males revealed no diel variation or change in estrogen levels due to the stress of bleedings. Although no gonadosomatic index-estrogen relationship could be demonstrated for either sex, there was correlation between oestrogen and androgen levels in the female. (Authors)

16477. Pristas, Paul J., and Randall P. Cheek (NMFS, Atlantic Estuarine Fish. Center, Beaufort, North Carolina 28516). 1973. ATLANTIC THREAD HERRING (Opisthonema oglinum) - MOVEMENTS AND POPULATION SIZE INFERRED FROM TAG RETURNS. NOAA Fishery Bull., 71(1): 297-301.

16478. Ballard, William W. (Biol. Dept., Dartmouth College, Hanover, New Hampshire). 1973. A NEW FATE MAP FOR Salmo gairdneri. J. Exp. Zool., 184(1): 49-74.

Chalk granules implanted among the cells of the stage 7 blastodisc are carried along with the cells to final location in the differentiating tissues and organs. The results, more often than not, are inconsistent with predictions suggested by an earlier fate map for Salmo (Pasteels, '36). Granules vertically thrust into a given spot on the blastodisc are usually carried to various levels of the trunk and to a variety of organs, presumably because cells at different depths of one spot and at different distances from the center are moving at different rates. Data from hundreds of such implants are assembled into charts showing the areas from which cells are drawn, to contribute to formation of the endoderm, notochord, five separate zones of the central nervous system, the head mesoderm, anterior and posterior trunk somites, tail somites, lateral plate, and heart. Using evidence of the overlapping and intergradation of these areas, as well as evidence from vital dyes when allowed to penetrate to various depths of the pregastrular blastodisc, a three-dimensional fate map is synthesized for Salmo gairdneri, which is very different from the earlier map, but consistent with the previously reported patterns of morphogenetic movements in this species (Ballard, '73b). In contrast with the gastrulation of amphibia and birds, Salmo germ layers arise without any invagination, and there is at no time an anterior mesoderm-free area. Previous efforts to generalize upon vertebrate gastrulation and its evolution within the phylum seem to have been premature. (Auth.)

16479. Speece, Richard E. (Dept. of Civil Eng., Univ. of Texas at Austin, Austin, Texas 78712). 1973. TROUT METABOLISM CHARACTERISTICS AND THE RATIONAL DESIGN OF NITRIFICATION FACILITIES FOR WATER REUSE IN HATCHERIES. Trans. Amer. Fish. Soc., 102(2): 323-334.

The literature has been reviewed and quantitative relationships have been derived to express the oxygen required, ammonia, BOD, and suspended solids production as a function of fish length. The temperature dependence of feeding rate and nitrification capacity has been incorporated into a nomograph which predicts the nitrification volume requirements for recycle. Another nomograph was constructed to predict water flow requirements and pollution resulting from trout hatchery operation. (Auth.)

16480. Alt, Kenneth T., and Dennis R. Kogl (Alaska Dept. of Fish & Game, Div. of Sport Fish, Fairbanks, Alaska). 1973. NOTES ON THE WHITEFISH OF THE COLVILLE RIVER, ALASKA. J. Fish. Res. Bd. Canada, 30(4): 554-556.

Five whitefish species are present in the Colville River. Least cisco (Coregonus sardinella) was the most common species in the Colville Delta, while the broad whitefish (C. nasus) was most abundant at test net sites near Umiat. Limited age and growth data indicate slower growth than in interior Alaska waters. (Authors)

16481. Pechurenkov, V. L., I. A. Shekhanova, and I. G. Telysheva (All-Union Res. Inst. for Sea Fish. and Oceanogr. (VNIRO), Moscow, USSR). 1972. THE EFFECT OF CHRONIC SMALL DOSE IRRADIATION ON THE EMBRYONIC DEVELOPMENT OF FISHES AND THE VALIDITY OF VARIOUS ASSESSMENT METHODS. J. Ichthyol., 12(1): 71-79.

A study was made of the effect of four radionuclides on the embryonic development of three species of fish and an assessment was made of the validity of the use of various tests for comparison of experimental and control variants. It was found that the Kolmogorov-Smirnov test was the simplest and most reliable test for comparison, but we were unable by its means to establish the effect of the radionuclides under investigation on the embryonic development of the fish.

16482. Miller, Grant L., and Sherrell C. Jorgenson (3058 Crescent Drive, Salt Lake City, Utah 84106). 1973. MERISTIC CHARACTERS OF SOME MARINE FISHES OF THE WESTERN ATLANTIC OCEAN. NOAA Fishery Bull., 71(1): 301-312.

16483. Sangalang, G. B., and M. J. O'Halloran (Fish. Res. Bd. of Canada, Halifax, Nova Scotia, Canada). 1972. CADMIUM-INDUCED TESTICULAR INJURY AND ALTERATIONS OF ANDROGEN SYNTHESIS IN BROOK TROUT. Nature, 240(5382): 460-461; Selected Water Resources Abstracts, 6(10): p. 54.

In fish exposed to 25 ppb cadmium for 24 hours, testes were abnormally vascularized and discolored. The LD (50) for brook trout exposed to 10 ppm Cd in a freshwater continuous flow system was found to be 21 days. In neither group was there damage to the primordial germ cells. In the damaged testes, a reduction of lipid material indicated that androgen production might have been disturbed. Tissue from the damaged testes produced less 11-hydroxytestosterone and testosterone when incubated with radio-labelled pregnenolone than did control fish tissue. Biosynthesized labelled 11 ketotestosterone was detectable in the control but not in the Cd-damaged tissue incubate. Analysis of normal testicular tissue incubated with varying amounts of cadmium showed that Cd inhibited the conversion of exogenous pregnenolone to free steroids. Cadmium inhibited the biosynthesis of 11 KT from pregnenolone. In 1000 μg Cd/g incubated tissue there was a general reduction in product yields of 11 KT, 11 OHT and T. Apparently non-lethal levels of pollutants have adverse effects on the reproductive physiology of fish.

16484. Tuunainen, Pekka, Kaj Granberg, and K. Matti Lappalainen. 1971. LAKE PÄIJÄNNE RESEARCH. Aqua Fennica, pp. 131-142.

This report deals with the limnological and fishery biological studies carried out on Lake Päijänne. Attention is also paid to the aspects, which led to the establishment of Hydrobiological Research Institute of Jyväskylä, where these investigations have now become concentrated, as well as to the economical value of the lake. (Authors' summ.)

16485. Nakagawa, Heisuke, and Yasuhiko Tsuchiya (Dept. of Fish., Fac. of Fish. and Animal Husb., Hiroshima Univ., Fukuyama, Japan). 1972. STUDIES ON RAINBOW TROUT EGG (Salmo gairdnerii irideus) IV. CHANGES OF YOLK CONTENT DURING EMBRYOGENESIS. J. Fac. Fish. Hiroshima, 11(2): 111-118.

Analysis of rainbow trout yolk during development was made on the moisture, lipid, protein, and non-proteic nitrogen occurring concurrently in the yolk sac before consumption by the embryo. Electrophoretic analysis of the protein showed three components distributed there in the ratio of about 83:11:6, decreasing with the same ratio through all the developmental stages, although a change of the lipid content in the lipoprotein after hatching was observed. The lipid of lipoprotein rapidly decreased and was consumed preferentially to the oil globule. (Authors' summ.).

16486. Dushkina, L. A. (The Polar Res. Inst. of Mar. Fish. and Oceanogr. (PINRO); Murmansk, USSR). 1973. INFLUENCE OF SALINITY ON EGGS, SPERM AND LARVAE OF LOW-VERTEBRAL HERRING REPRODUCING IN THE COASTAL WATERS OF THE SOVIET UNION. Marine Biology, 19(3): 210-223.

Clupea harengus pallasi deposit their eggs in the coastal zone, which is the most dynamic part of the sea in respect to its regime. Salinity is one of the most variable factors on the spawning grounds. Observations were made in the seas of the European North and Far East, and in experiments where salinities varied from 0 to 70 °/oo. Study of the influence of salinity on the development of sea herring eggs is of interest for several reasons. Firstly, salinity fluctuation patterns differ in different parts of a given habitat. In each area inhabited, salinity boundaries exist within which eggs can develop normally. Secondly, the levels of limiting salinities on spawning grounds differ noticeably in different seas. Hence, attention was paid to population-specific differences in the responses of eggs to salinity. Finally, detailed knowledge on the responses of sexual cells to low-salinity conditions helps to elucidate the ecological situation in areas with reduced salinity, and the reproductive potential of the population considered. Sexual cells of numerous populations of Pacific herring are capable of fertilization over a wide range of salinities. Fertilizability in low salinities and, partially, also in high salinities, reveals a population specificity. The responses of the eggs of C. harengus pallasi

to reduced salinities differ from those of C. harengus harengus. Osmotic resistance of eggs to low salinities is considerably higher in the first-mentioned subspecies. Under salinity stress, eggs reveal individual differences which are not seen under optimum conditions of salinity. In all populations studied, responses to salinity change during embryology. (Auth.)

16487. Ricker, W. E. (Fish. Res. Bd. Canada Biol. Sta., Nanaimo, British Columbia, Canada). 1973. LINEAR REGRESSIONS IN FISHERY RESEARCH. J. Fish. Res. Bd. Canada, 30(3): 409-434.

A number of regression situations in fish and fishery biology are examined, in which both of the variates are subject to error of measurement, or inherent variability, or both. For most of these situations a functional regression line is more suitable than the ordinary predictive regressions that have usually been employed, so that many estimates now in use are in some degree biased. Examples are (1) estimation of the exponent in the weight:length relationship, where almost all published values are somewhat too small; and (2) estimating the regression of logarithm of metabolic rate on log body weight of fish, where the best average figure proves to be 0.85 rather than 0.80. In the very common situation where the distribution of the variates is non-normal and open-ended, a functional regression is the most appropriate one even for purposes of prediction. Two ways of estimating the functional regression are (1) from arithmetic means of segments of the distribution, when computed symmetrically; and (2) from the geometric mean of one predictive regression and the reciprocal of the other. The GM regression gives a more accurate estimate when it is applicable; it is appropriate in all situations where the variability is mainly inherent in the material (little of it due to errors of measurement), or where the measurement variances are approximately proportional to the total variance of each variate; and it is the best estimate available for short series with moderate or large variability even when neither of these conditions applies. When error in X results solely from the measuring process the predictive regression of Y on X is also the functional regression if observations of X are not taken at random but rather have pre-established values, as is usual in experimental work. The uses of the various regressions are summarized in Table 8. (Auth.)

16488. Johnsen, Richard C., and Carl W. Sims (NMFS, Northwest Fish. Center, 2725 Montlake Blvd East, Seattle, Washington 98112). 1973. PURSE SEINING FOR JUVENILE SALMON AND TROUT IN THE COLUMBIA RIVER ESTUARY. Trans. Amer. Fish. Soc., 102(2): 341-345.

A 28-foot gillnetter was modified to catch juvenile salmon and steelhead trout by purse seining in the estuary of the Columbia River. This vessel and equipment enabled effective sampling with relative economy, practicality, and safety. The main limitation was the lack of space for handling fish. Juvenile salmon and steelhead trout comprised the majority of the catch. Also taken in large numbers were surf smelt, American shad, northern anchovy, and longfin smelt in brackish water and peamouth in fresh water. The incidental catch included cutthroat trout, Pacific herring, eulachon, threespine stickleback, carp, shiner perch, starry flounder, and largescale sucker. (Authors)

16489. Hemmings, C. C. (Mar. Lab., Aberdeen, Scotland). 1972. UNDERWATER PHOTOGRAPHY IN FISHERIES RESEARCH. Journal du Conseil, 34(3): 466-484.

Underwater photography is reviewed with particular respect to the recording of fish in relation to fishing gear by unmanned cameras. The attenuation of natural and artificial light are discussed. Object contrast and its attenuation through the medium are the main problems of underwater photography. Increase of photographic contrast has only limited scope, but other ways of improving image-recording are suggested. The mounting of cameras is related to the amount of information required which can be obtained from each photograph. Stereo photography and some motion analysis greatly increase the amount of information. Diver-operated cameras should be used in shallow water before constructing elaborate unmanned camera systems. (Auth.)

16490. Brigham, Warren U. (Ill. Natural History Survey, Urbana, Illinois). 1973. NEST CONSTRUCTION OF THE LAMPREY, Lampetra aepyptera. Copeia No. 1, pp. 135-136.

Nest construction activities of Lampetra aepyptera were observed during afternoon, 14 March 1966, in an unnamed tributary of Cane Creek, Caney Fork Drainage, Putnam County, Tennessee, approximately 10 km SSW of Cookeville.

16491. McQueen, A., K. MacKenzie, Ronald J. Roberts, and Hamish Young (Dept. of Dermatology, Univ. of Glasgow, Glasgow, Scotland). 1973. STUDIES ON THE SKIN OF PLAICE (Pleuronectes platessa L.) III. THE EFFECT OF TEMPERATURE ON THE INFLAMMATORY RESPONSE TO THE METACERCARIAE OF Cryptocotyle lingua (Creplin, 1825) (DIGENEA: HETEROPHYIDAE). J. Fish Biol., 5(2): 241-247.

Eighty-nine O-group plaice from a natural population were exposed at 15°C to heavy infection by Cryptocotyle lingua cercariae. Subsequently 45 fish were retained at 15°C, whilst 44 were held at 5°C. Both groups were sampled by killing individual fish at intervals of 6, 18, 42 h and daily thereafter up to 710 h. Entire fish were fixed immediately in formol saline, transversely sectioned and stained by H & E, PAS, PAS-diastase, JSDB 109, Picro-Mallory, Masson's trichrome, Gram-Weigert and Alcian blue. Histopathological observations showed: (a) epidermal lesions associated with encysted metacercariae in adjacent tissues; (b) myofibrillar necrosis associated with bacteria possibly introduced by the parasite; and (c) a reactive swelling of the intermuscular septa. The progressive development of the parasite cyst and host capsule is described. Development of both was markedly inhibited at the lower temperature, but the inflammatory response at either temperature was slight. This may be evidence of a long-standing host-parasite relationship which has evolved to an advanced state of adaptation on the part of the parasite and tolerance on the part of the host. (Authors)

16492. Ryabov, A. K., B. I. Nabivanets, Zh. M. Aryamova, Ye. M. Palamarchuk, and I. S. Kozlova (Inst. of Hydrobiol., Ukr. Acad. of Science, Kiev, USSR). 1972. EFFECT OF ARTIFICIAL AERATION ON WATER QUALITY. Hydrobiological Journal, 8(1): 49-52.

Preliminary findings show that artificial aeration alters the qualitative and quantitative composition of the algoflora and sharply intensifies the decomposition and mineralization of nitrogenous organic compounds.

16493. Haider, Gerhard (Inst. for Community Water Supply and Water Quality Control of the Univ. of Stuttgart, Germany). 1973. HEMATOLOGICAL OBSERVATIONS ON RAINBOW TROUT (Salmo gairdneri Rich.) VII. COLOR INDEX (CI), ABSOLUTE HEMOGLOBIN CONTENT OF THE INDIVIDUAL ERYTHROCYTE (MCH) AND AVERAGE HEMOGLOBIN CONCENTRATION OF THE INDIVIDUAL ERYTHROCYTE (MCHC). [Hämatologische Beobachtungen an Regenbogenforellen (Salmo gairdneri Rich.) VII. Färbeindex (FI), absoluter Hämoglobingehalt des Einzelerythrozyten (Hb_E) und mittlere Hämoglobinkonzentration des Einzelerythrozyten (MCHC)]. Hydrobiologia, 41(1): 57-76. In German with English abstract.

One hundred and eighty rainbow trout (Salmo gairdneri Rich.), aged from 1 to 3 years, were examined for fluctuations, caused by age and season, by means of colour index (CI), mean corpuscular hemoglobin (MCH), and mean corpuscular hemoglobin concentration (MCHC). CI and MCH behave similarly. Both increase until the 2nd year and stay relatively constant thereafter. If the gender is not considered - there are no significant differences in the values of males and females - the CI increases from 1.4 in the first year over 1.6 to 1.7 in the age of 3 years, and the MCH increases from 44.4 γγ over 52.6 γγ, 56.8 γγ, 58.1 γγ to 55.5 γγ. A seasonal periodicity of both indices could not be indicated on not-matured animals (F_2) which were two summers of age. Only the January values appeared increased - CI:2, MCH:68.3 γγ - otherwise the CI varies between 1.8 and 1.7 and the MCH between 53.3 γγ and 59.1 γγ. The MCHC-values of the age groups examined vary between 24.4% and 27.3%. The values of the yearlings form an exception (19.8%). These values certainly are inexact and too low because of the small number of individuals checked (3). No fluctuations of this parameter caused by season appear among the F_2. The medium values range between 22.5% and 27.6%. (Auth.)

16494. Zaika, V. Ye., and N. A. Ostrovskaya (Inst. of the Biol. of Southern Seas, Ukr. Acad. of Sci. (InBYuM), Sevastopol). 1972. INDICATORS OF THE AVAILABILITY OF FOOD TO FISH LARVAE I. THE PRESENCE OF FOOD IN THE INTESTINES AS AN INDICATOR OF FEEDING CONDITIONS. J. Ichthyol., 12(1): 94-103.

A mathematical description and analysis is given of the indicator k, which reflects the proportion of fish with food in the intestines in relation to food concentration for different feeding stereotypes. What is implied here is an established feeding regime. The equations which are presented reflect the relationship between k and p in Azov and Black Sea anchovy larvae. It is, moreover, possible to explain the apparent incompatibility between p and the low k values observed in many clupeids.

16495. Cowey, C. B., J. A. Pope, J. W. Adron, and A. Blair (with an appendix on statistics by J. A. Pope and A. M. Shanks). (Nat. Environ. Res. Council, Inst. of Mar. Biochem., Aberdeen, Scotland, UK). 1973. STUDIES ON THE NUTRITION OF MARINE FLATFISH. THE EFFECT OF ORAL ADMINISTRATION OF DIETHYLSTILBOESTROL AND CYPROHEPTADINE ON THE GROWTH OF Pleuronectes platessa. Marine Biology, 19(1): 1-6.

Two organic compounds, diethylstilboestrol a synthetic oestrogen substitute, and cyproheptadine which acts as an appetite stimulant in some mammals, were added separately at 3 different concentrations to diets fed to plaice (Pleuronectes platessa), and their effect on growth examined. Over a 10 week period, low orally-administered diethylstilboestrol (600 μg/kg moist diet) gave rise to increased weight gain, food consumption and food conversion. Higher dietary concentrations of diethylstilboestrol (up to 2400 μg/kg diet) were without effect on these parameters. Cyproheptadine did not stimulate appetite, weight gain or food conversion at any of the levels tested. (Authors)

16496. Schaefer, Richard H. (N. Y. State Dept. of Environ. Conservation, New York). 1972. FIRST RECORD OF A SNOOK FROM NEW YORK WATERS. N. Y. Fish and Game Journal, 19(2): p. 182.

The capture of a snook (Centropomus sp.) from New York waters was recently reported by Vetter (1971). Subsequent contact with this author revealed that the fish, approximately 11 inches (280 millimeters) in total length, was taken on hook and line from Barnum's Channel near Island Park, N. Y. in early October of 1969. Although the specimen was photographed immediately after capture, it unfortunately was not retained for closer biological examination. In spite of the absence of corroborating data, however, there seems no reason to doubt the authenticity of the report or the generic identification of the specimen. Moreover, the morphological characteristics of the photographed specimen seem to conform closely to the description given by Rivas (1962) for the common snook (Centropomus undecimalis).

16497. Chidambaram, S., R. K. Meyer, and A. D. Hasler (Dept. of Zool. and the Endocrin.-Reprod. Physiol. Program, The Univ. of Wisconsin, Madison, Wis.) 1973. EFFECT OF HYPOPHYSECTOMY, ISLETECTOMY AND ACTH ON GLYCEMIA AND HEMATOCRIT IN THE BULLHEAD, Ictalurus melas. J. Exp. Zool., 184(1): 75-80.

Effect of hypophysectomy, isletectomy and ACTH on glycemia and hematocrit in Ictalurus melas were studied. The mean blood glucose (BG) and hematocrit in intact untreated fish were found to be 69.65 mg/100 ml and 33.7% respectively. Following hypophysectomy there was a 73.1% decrease in BG and a 50% decrease in the hematocrit. Changes in sham-operated controls were insignificant. Eight IU of porcine ACTH administered in two injections on days 6 and 8 post-hypophysectomy increased the BG to pre-hypophysectomy level and the hematocrit to 70% of its initial value on day 9, whereas in vehicle injected controls BG and hematocrit values remained at their post-hypophysectomy level. Isletectomy caused hyperglycemia in all the experimental animals. It induced a net increase of 142.3% over the pretreatment BG compared to 5.2% increase in sham-operated controls. Isletectomy unlike hypophysectomy did not produce any significant change in the hematocrit. (Authors)

16498. Jolly, D. W., L. E. Mawdesley-Thomas, and D. Bucke (Huntingdon Res. Centre, Huntingdon, England). 1972. ANAESTHESIA OF FISH. The Veterinary Record, October, pp. 424-426; Fish Health News, 2(2): p. 13.

Fish can be sedated or anaesthetised by immersion in a solution of an anaesthetic agent which is absorbed into the blood stream through the gill lamellae. Anaesthesia can be induced within one to two minutes with a solution of 25-300 mg per litre of tricaine methanesulphonate and within one minute using one to four ppm of propoxate. The anaesthetised fish can be removed from water, placed on a damp cloth, and subjected to a surgical or diagnostic exercise. When returned to clean water the fish recovers within five to ten minutes. The effects on fish of a number of other anaesthetic agents have been assessed. (Authors' summ.)

16499. Roche, Edward T., and James A. St. Amant. 1973. POTENTIAL DANGER FROM THE INDIAN CATFISH, Heteropneustes fossilis (Bloch). Calif. Fish and Game, 59(2): 144-145.

The dangers of handling Indian catfish are pointed out. It is illegal to import this fish into California. Nevertheless, these fish show up occasionally in shipments to fish dealers.

16500. Laurence, Geoffrey C. (NMFS, Northeast Fish. Center, Narragansett Lab., Narragansett, R. I. 02882). 1973. INFLUENCE OF TEMPERATURE ON ENERGY UTILIZATION OF EMBRYONIC AND PROLARVAL TAUTOG, Tautoga onitis. J. Fish. Res. Bd. Canada, 30(3): 435-442.

When daily energy budgets were calculated by two methods for tautog, Tautoga onitis, from fertilization to complete yolk absorption at three temperatures (16, 19, and 22 C), neither method indicated a deficiency of yolk energy for growth and metabolism prior to exogenous feeding capability. Deficits were indicated on the day of feeding capability at all temperatures by the oxygen consumption method, the more precise but less inclusive of the two. The dry weight method, which gave the more conservative estimates, indicated no deficit for the entire period of yolk absorption at 16 C, a deficit one day after feeding capability at 19 C, and a deficit on the day of feeding capability at 22 C. Regression analysis of oxygen consumption indicated that 22 C may be in the upper temperature limits for normal metabolism by embryonic and prolarval tautog. Yolk utilization efficiencies and postlarval size at complete yolk absorption tended to be inversely related to temperature. The ecological implications and the effects of temperature on the critical timing involved in the interactions of feeding capability, availability of prey and occurrence of energy deficits are discussed. (Auth.)

16501. Bourne, Earl W., and Roy W. Jones (Dept. of Biol., Univ. of New Mexico, Albuquerque, New Mexico 87106). 1973. EFFECTS OF 7, 12-DIMETHYLBENZ (A) ANTHRACENE (DMBA) IN FISH CELLS IN VITRO. Trans. Amer. Micros. Soc., 92(1): 140-142.

Fish cells of two different types were exposed to media containing DMBA in various concentrations. Fibroblasts from rainbow trout gonads (RTG-2) were more sensitive to the inhibition of mitosis by DMBA than were epithelioid cells from the fathead minnow (FHM). However, FHM cells showed a marked increase in multinucleate cells as a result of the treatment while the RTG-2 cells did not. (Authors)

16502. Kroger, Richard L. (Dept. of Zool. and Physiol., Univ. of Wyoming, Laramie, Wyo.). 1973. BIOLOGICAL EFFECTS OF FLUCTUATING WATER LEVELS IN THE SNAKE RIVER, GRAND TETON NATIONAL PARK, WYOMING. Amer. Midl. Nat., 89(2): 478-481.

The effects of fluctuating water levels - which result from variation in the demand for irrigation water released through Jackson Lake Dam - on aquatic biota in the Snake River in Grand Teton National Park were observed. Unnaturally low water levels and sudden decreases in water flow exposed the stream bed and destroyed algae, invertebrates and some fish and probably limited the production of other fish occupying higher trophic levels. This is evidently the first published report which shows that rapid changes in water levels leave aquatic invertebrates and some fish stranded on the exposed stream bed. (Auth.)

16503. Haines, Terry A. (Dept. of Fish. and Wildl., Michigan State Univ., East Lansing, Michigan 48823). 1973. EFFECTS OF NUTRIENT ENRICHMENT AND A ROUGH FISH POPULATION (CARP) ON A GAME FISH POPULATION (SMALLMOUTH BASS). Trans. Amer. Fish. Soc., 102(2): 346-354.

This experiment was conducted to test the effects of nutrient enrichment and a rough fish population, individually and in combination, on a game fish population. The rough fish and game fish species used were carp (Cyprinus carpio L.) and smallmouth bass (Micropterus dolomieui Lacépède) respectively. Two fertility levels (low and high) were established in a series of artificial ponds. Low fertility ponds were undisturbed, while nitrogen and phosphorus were added biweekly (i.e., once every 2 weeks) to the high fertility ponds. Replicates of three fish population types were established at each fertility level: game fish only, rough fish only, and game and rough fish in combination. Physical, chemical and biological conditions in the ponds were measured regularly; the fish populations were censused after 15 months. Growth rate was used as an index of the status of the fish populations. The growth rate of each species was not significantly ($p = 0.5$) affected by species interactions at either fertility level. Bass growth rate in high fertility ponds was significantly ($p < 0.01$) lower than in low fertility ponds; carp growth rate in high fertility ponds was significantly ($p < 0.01$) higher than in low fertility ponds. The depression of bass growth rate in high fertility ponds may have resulted from the increased diurnal dissolved oxygen flux, decreased water clarity, or increased ammonia concentrations. Carp apparently were not affected by these factors and were able to utilize the increased food supply in the enriched ponds. (Auth.)

16504. Zettler, F. W., and T. E. Freeman (Dept. of Plant Pathology, Fla. Univ., Gainesville, Florida). 1972. PLANT PATHOGENS AS BIOCONTROLS OF AQUATIC WEEDS. Ann. Review of Phytopathology, Vol. 10, pp. 455-470; Selected Water Resources Abstracts, 6(10): p. 58.

The potential role of plant pathogens as biocontrols of waterweeds is considered and existing literature pertinent to diseases of waterplants is reviewed. Whereas other biological control agents such as insects and fish have received considerable attention, researchers have largely overlooked plant pathogens as candidates for biocontrols of waterweeds. Existing research shows that plant pathogens are well adapted to an aqueous environment and that they can inflict serious damage to waterplants. Among the advantages of using plant pathogens as biocontrols are: (a) control applications require minimum technology and pathogens, once applied, are self-maintaining, (b) plant pathogens offer an unmatched versatility in selecting a specific biocontrol, (3) plant pathogens, with rare exceptions, infect only plants and are not expected to be pathogenic to other life forms, and (d) plant pathogens, although often killing individuals within a population, are not likely to exterminate a given plant species. Research on this aspect of waterweed biocontrol should be expanded considerably. As other types of agents are eliminated as useful control agents, plant pathogens may ultimately prove to be the most important key of all in eliminating waterweeds.

16505. Ross, Michael R. (Museum of Zool., The Ohio State Univ., Columbus, Ohio 43210). 1973. A CHROMOSOME STUDY OF FIVE SPECIES OF ETHEOSTOMINE FISHES (PERCIDAE). Copeia No. 1, pp. 163-165.

The five species studied, with current subgeneric status in parentheses, are E. (Etheostoma) blennioides Rafinesque, E. (Boleosoma) nigrum Rafinesque, E. (Nothonotus) camurum (Cope), E. (Oligocephalus) caeruleum Storer, and E. (Catonotus) flabellare Rafinesque. The subgenera represented by these species are morphologically diverse taxa within Etheostoma. The species were selected to determine if morphological diversity within the genus might be paralleled by karyological diversity. All species studied have a diploid number of 48. No evidence of chromosomal heterogamety was found in any species. Male and female karyotypes within each species are morphologically identical. Although the diploid number is constant, all species studied have distinctive karyotypes. E. blennioides possesses the only intraspecific chromosomal polymorphism observed.

16506. Wolf, Ken, and M. C. Quimby (Eastern Fish Disease Lab., Bur. of Sport Fish. & Wildl., Kearneysville, West Virginia 25430). 1973. FISH VIRUSES: BUFFERS AND METHODS FOR PLAQUING EIGHT AGENTS UNDER NORMAL ATMOSPHERE. Reprint from Applied Microbiology, 25(4): 659-664.

A universal procedure was sought for plaque assay of eight fish viruses (bluegill myxovirus, channel catfish virus, eel virus, Egtved virus, infectious hematopoietic necrosis virus, infectious pancreatic necrosis virus, lymphocystis virus, and the agent of spring viremia of carp (Rhabdovirus carpio), in dish cultures of various fish cells. Eagle minimal essential medium with sodium bicarbonate-CO_2 buffer (Earle's salt solution) was compared with minimal essential medium buffered principally with tris (hydroxymethyl) aminomethane or N-2-hydroxyethylpiperazine-N'-2'-ethanesulfonic acid at a pH or in the range of 7.6 to 8.0 depending upon temperature. Five fish cell lines collectively capable of replicating all fish viruses thus far isolated were tested and quantitatively found to grow comparably well in the three media. Two-phase (gel-liquid) media incorporating the various buffer systems allowed plaquing at 15 to 33 C either in partial pressures of CO_2 or in normal atmosphere, but greater efficiency and sensitivity were obtained with the organic buffers, and, overall, the best results were obtained with tris(hydroxymethyl)-aminomethane. Epizootiological data, specific fish cell line response, and plaque morphology permit presumptive identification of most of the agents. At proper pH, use of organic buffers obviates the need for CO_2 incubators. (Authors)

16507. Van Hyning, Jack M. (Fish Comm. of Oregon, Portland, Oregon 97201). 1973. FACTORS AFFECTING THE ABUNDANCE OF FALL CHINOOK SALMON IN THE COLUMBIA RIVER. Research Reports of the Fish Comm. of Oregon, 4(1): 87 p.

The population of Columbia River fall chinook salmon (Oncorhynchus tshawytscha, Walbaum) was studied to determine the cause of a severe decline in the numbers of fish returning to the river in the late 1940's and early 1950's. Fluctuations in abundance of other major salmon runs in the North Pacific were examined to detect any coastwide pattern but none was apparent. Life history stages during marine life, upstream migration, reproduction and incubation, and downstream migration were examined for the pre-(1938-46) and post-decline (1947-59) year classes. Salient points determined from the analysis were: (1) a change in the maturity and survival pattern occurred about 1950; (2) a significant negative correlation was found between sea-water temperature during the first year at sea and subsequent survival; (3) a large increase in the ocean fisheries occurred coincident with the decline in the run; (4) catch-effort and biological statistics of the ocean fisheries showed a near classic example of the effects of exploitation; (5) the contribution of Columbia River chinook to the ocean fisheries based on tag recoveries was probably greatly underestimated; (6) a significant inverse correlation between estimated ocean catch of Columbia River fall chinook and numbers entering the river was found for the post-decline period; (7) the gill-net fishery showed little selectivity by age, size, or sex; (8) fluctuations in abundance of hatchery stocks were related to differences in survival between fingerling and adult stages; (9) hatchery, lower river, and upriver populations fluctuated in abundance in much the same pattern; (10) optimum escapement was between 90,000 and 100,000 adults, a value that was exceeded during most years; (11) most of the early dams on the Columbia River had no direct effect on fall chinook and the decline in productivity occurred when river conditions were relatively stable; (12) temperatures at time of upstream migration and spawning had not increased enough to be a serious mortality factor; (13) river conditions at time of downstream migration of fingerlings were but slightly related to subsequent return of adults. Variables that appeared to have some relation to fluctuations in abundance were submitted to multiple regression analysis. For the pre-decline period, sea-water temperature and ocean troll fishing effort were significant. For post-decline years, troll effort had the most influence on total returns with ocean temperature and escapement having lesser effects. For the combined years, troll intensity and ocean temperature were the significant variables. Equations were derived that predicted the returning run size in close agreement with the actual. Substituting a low and constant ocean fishing effort in the equation resulted in the predicted run maintaining

the average pre-decline level. The hypothesis of the increase in ocean fishing being the main contributor to the decline of Columbia River fall chinook run was confirmed by correlation, by analogy, and by the process of elimination. Due to several unique features in their life history, they are exposed to much more ocean fishing than other populations; thus other runs did not show similar declines. It is emphasized that these conclusions should not be extrapolated to the future or to other species or runs of salmon. (Auth.)

16508. Hiscox, J. I., and R. W. Brocksen (Dept. of Animal Physiol., Univ. of Calif., Davis, California 95616). 1973. EFFECTS OF A PARASITIC GUT NEMATODE ON CONSUMPTION AND GROWTH IN JUVENILE RAINBOW TROUT (Salmo gairdneri). J. Fish. Res. Bd. Canada, 30(3): 443-450.

A technique was developed for differentially infecting juvenile rainbow trout, Salmo gairdneri, by introduction of the parasitic gut nematode, Bulbodacnitis ampullastoma. Desired infection levels were induced in trout with 80% success. B. ampullastoma affected growth and food consumption of trout in the laboratory. The effects of the parasite were evident at low and high ration levels. At low and starvation ration levels the parasite effected a withdrawal of the energy stores of the fish. At higher ration levels, the direct effects of the parasite were compounded by apparent parasite interference with food assimilation by the fish. B. ampullastoma was directly infective to a warmwater fish, Lepomis cyanellus. (Authors)

16509. Espinosa, F. A., Jr., and James E. Deacon (Dept. of Biol. Sci., Univ. of Nevada, Las Vegas, Nevada 89109). 1973. THE PREFERENCE OF LARGEMOUTH BASS (Micropterus salmoides Lacépède) FOR SELECTED BAIT SPECIES UNDER EXPERIMENTAL CONDITIONS. Trans. Amer. Fish. Soc., 102(2): 355-362.

The preference of largemouth bass for selected bait species was tested under experimental conditions. Three fish species and one species of larval salamander were utilized in preference experimentation: Notemigonus crysoleucas, Carassius auratus, Lepidomeda mollispinis, and Ambystoma tigrinum. Preference experiments were conducted in 2.4 and 3.0 m plastic wading pools. A total of 23 bass, varying in weight from 84-499 g, was utilized in determining single, group and replicate profiles. Replicate experimentation was conducted with previously tested bass and/or bait combinations. Twenty-five experiments were completed which included 28 trial periods (14 single and 14 group) with a total trial time of 190 days. Largemouth bass showed a significant preference for spinedace and waterdogs over golden shiners and goldfish. However, bass did not show a significant preference for either species when spinedace and waterdogs were tested against each other. Goldfish were the least preferred bait item. The order of preference did not change when the number of bass and the number of bait species offered were changed. The size of bass and change in size of bait items from trial to trial did not appear to have any substantial impact on preference, except in trials involving the golden shiner/waterdog combination. Vulnerability, palatability, behavior, and perhaps size of prey organisms affect the feeding behavior of bass in nature and under experimental conditions. (Authors)

16510. Thorson, Lee C., and Mary Ellen Engett (Scientific Publications Staff, NMFS, Seattle, Washington). 1973. FISHERY PUBLICATIONS, CALENDAR YEAR 1969: LISTS AND INDEXES. NOAA Technical Report NMFS CIRC-379, 31 p.

The following series of fishery publications of the National Marine Fisheries Service, National Oceanic and Atmospheric Administration (until October 1970 the Bureau of Commercial Fisheries of the U.S. Fish and Wildlife Service) in calendar year 1969 are listed numerically (with abstracts) and indexed by author, subject, and geographic area: Circular, Data Report, Fishery Industrial Research, Fishery Leaflet, and Special Scientific Report-Fisheries. (Authors)

16511. Erdman, Donald S. 1972. INLAND GAME FISHES OF PUERTO RICO. Dept. of Agriculture, San Juan, Puerto Rico, 96 p., illus.

16512. Nelson, Joseph S. (Dept. of Zool., The Univ. of Alberta, Edmonton, Alberta, Canada). 1973. OCCURRENCE OF HYBRIDS BETWEEN LONGNOSE SUCKER (Catostomus catostomus) AND WHITE SUCKER (C. commersoni) IN UPPER KANANASKIS RESERVOIR, ALBERTA. J. Fish. Res. Bd. Canada, 30(4): 557-560.

Hybrids between longnose sucker (Catostomus catostomus) and white sucker (C. commersoni) identified on the basis of intermediacy in several scale counts and in morphometric data, are recorded for the first time from Canada. The weakening of isolating mechanisms permitting hybridization was attributed to environmental factors, particularly species introduction and habitat disturbance. There was no evidence of swamping. (Auth.)

16513. Johnston, I. A., and G. Goldspink (Muscle Res. Lab., Dept of Zool., Univ. of Hull, Hull, Yorkshire, England). 1973. A STUDY OF THE SWIMMING PERFORMANCE OF THE CRUCIAN CARP Carassius carassius (L.) IN RELATION TO THE EFFECTS OF EXERCISE AND RECOVERY ON BIOCHEMICAL CHANGES IN THE MYOTOMAL MUSCLES AND LIVER. J. Fish Biol., 5(2): 249-260.

A study has been made of the maximum sustained swimming speed of Crucian carp Carassius carassius (L.) using a fixed velocity technique. The data obtained from swimming tests on 214 carp have been analysed using the method of probit analysis. The 50% fatigue level for 13-16 cm fish acclimated to 9.6 $\pm$ 0.6°C has been estimated to be 3.35 length/sec. Biochemical measurements have been made on the red and white myotomal muscles and liver of fish subjected to both varying intensities of sustained swimming and short periods of vigorous swimming. Free creatine was found to increase only during high speed swimming in the white muscle. Elevated lactate concentrations occurred at both low and high sustained swimming speeds in the red superficial muscle but not during short periods of strenuous exercise. Glycogen depletion from the red musclulature also only took place at the sustained swimming speeds investigated. The reverse situation was operative in the white muscle, significant glycogen depletion occurring only at the highest swimming speed studied. Lactate levels were only significantly different from non-exercised fish in the fish swimming at the higher velocities. The effects of periods of recovery following 200 min of sustained swimming were also investigated. White muscle lactate was at a higher level than non-exercise fish 5 h post-exercise, while both red muscle glycogen and lactate rapidly returned to pre-exercise concentrations. Biochemical measurements on the myotomal muscle types have been discussed in relation to the swimming performance of the fish and the division of labour between red and white fibres. (Authors)

16514. Larmoyeux, Jack D., and Robert G. Piper (Bur. Sport Fish. & Wildl., Fish Cultural Development Center, Bozeman, Montana 59715). 1973. EFFECTS OF WATER REUSE ON RAINBOW TROUT IN HATCHERIES. Progr. Fish-Cult., 35(1): 2-8.

Reduction in quality of hatchery water by reuse through a series of raceways had observable detrimental effects on rainbow trout. When oxygen levels declined below 5 ppm and ammonia nitrogen levels exceeded 0.5 ppm, a decline in fish quality was evidenced by reduction in growth rate, damage to gill tissue, and occasional pathology in kidney and liver tissue. Facilities and experimental design did not permit differentiation between effects of reduction in oxygen and build-up of metabolites. (Authors)

16515. Sirenko, L. A., N. V. Avil'tseva, and V. M. Chernousova (Inst. of Hydrobiol., Ukr. Acad. of Sci., Kiev, USSR). 1972. EFFECT OF ARTIFICIAL AERATION OF POND WATER ON THE ALGAL FLORA. Hydrobiological Journal, 8(1): 52-58.

Aeration of ponds by bubbling results in destratification and uniform oxygen concentration throughout the pond, thereby eliminating stagnant zones with a low oxygen content in the bottom layers. Aeration also greatly changes the nature of the algal communities. The blue-green algae responsible for water blooms are eliminated, the development of other algal groups, chiefly the Protococcaceae, is promoted. Water quality is also improved. (Authors)

16516. Harris, Jack, and Stephen Hunt (Dept. of Biol. Sci., Univ. of Lancaster, Bailrigg, Lancaster, United Kingdom). 1973. EPITHELIAL MUCINS OF THE ATLANTIC SALMON (Salmo salar L.). Biochem. Soc. Trans, 1(1): 153-155; Marine Fisheries Abstracts, 26(6): p. 1.

[Mucins, composed of conjugated carbohydrates and proteins, occur in mucus and saliva and are widely distributed in nature. The mucous membrane is a tissue lining of tubular cavities (such as the gut, uterus, and trachea), and it consists of a layer of epithelium containing many single-celled mucous glands. These glands secrete mucus. Abstractor's note]. Preliminary analysis of the mucus components of salmon were performed relative to secretion of mucus from the epidermis. Chromatography and further electrophoresis of whole mucus revealed three major components. Continued analysis indicated the presence of mannose, jucose, glucose, galactose, glucosamine, and galactosamine. Protein content of the mucus was 62% of the dry weight; seventeen amino acids were present, with serine, threonine, histidine, glycine, glutamic acid, and aspartic acid predominating. No free thiol groups were present.

16517. Dlugosz, Miroslawa (WSR Olsztyn, Wydzial Ochrony Wod i Rybactwa Srodladowego, Instyutut Rybactwa Srodladowego). 1973. DETECTION OF HEMOGLOBIN IN THE EMBRYONIC AND LARVAL STAGES OF DEVELOPMENT OF THE RAINBOW TROUT (Salmo gairdneri Richardson 1836). [Przyzyciowe wykrywanie hemoglobiny w okresie rozwoji embrionalnego i larwalnego pstraga teczowego (Salmo gairdneri Richardson 1836)]. Roczniki Nauk Rolniczych, 95(1): 7-23. In Polish with English synopsis.

The aim of the investigations was to catch the point of hemoglobin appearance, and to make a thorough study of the arrangement of blood vessels during the embryonic and larval stages of development of the rainbow trout. The first positive benzidine reaction was obtained at the nineteenth day of embryonic development (at 132.3 D°). The prime hemogenous focuses were noticed on the surface of the yolk sac. (Auth. synopsis)

16518. Stewart, Robert W., and Walter S. Murawski (N. J. Dept. of Environ. Protection, Freshwater Fish. Lab., Lebanon, New Jersey). 1973. EVALUATION OF THE CHANNEL CATFISH, Ictalurus punctatus, Rafinesque, IN NEW JERSEY. Misc. Report No. 37 of N. J. Dept. of Environ. Protection, Freshwater Fish. Lab., Lebanon, N. J., 27 p.

This report covers all of the findings of several studies which have attempted to establish the channel catfish, Ictalurus punctatus, Refinesque, in New Jersey waters since 1953. During the course of these efforts with channel catfish in New Jersey four different sources of fish were used: Lake Erie, a private hatchery, a Federal hatchery and the Delaware River. Successful reproduction from these introductions was achieved only from adult fish obtained from Lake Erie and then only in one lake (Branch Brook Park Lake) for a period of two years. Examination of ovaries from fish from the Delaware River and stocked in Harrisonville Lake showed no evidence that the spawning cycle had been completed. In-situ bioassays in a number of acid water lakes in the State showed that although capable of surviving down to a pH of 5.7, mortality occurred in fish held in waters of pH 4.7 and 4.1. Although very few direct observations on growth were obtained by project personnel, a cooperative creel census at Deer Lake provided reasonably reliable estimates of growth of private hatchery reared fish and they are as follows: two-year olds - 13.1", three-year olds - 15.3", four-year olds - 17.3", five-year olds - 19.1" and six-year olds - 19.7". From the Deer Lake creel census which was run before and after the introduction of channel catfish there appeared to be no effect of the channel catfish on the sport fishery of the indigenous species. This same creel census also showed that this specie immediately enters the fishery upon being stocked and is capable of surviving at least for the next five years. Further, this fish is caught most readily during the summer months when the largemouth bass fishery is at its poorest. Angler harvest on untagged fish provided returns as high as 40.7 percent under strictly controlled reporting conditions and on tagged Delaware River fish the returns ran as high as 42.0 percent, although a return of approximately 25 percent is a more realistic figure of this group of fish. Delaware

River channel catfish, although catchable once stocked in a lake, did have a tendency to leave the lake and drop downstream. In addition, they appeared not to grow as rapidly as the fish of hatchery origin. (Authors)

16519. Fisheries Research Board of Canada (Ottawa, Canada). 1973. ANNUAL REPORT 1972. Fish. Res. Bd. of Canada, Cat. No.: Fs 91-1972, 68 p. (In English and French).

Includes Chairman's Remarks plus Fisheries Resources, Products and Processing, and Environmental Quality for the Atlantic Region, the Central and Arctic Regions and the Pacific Region.

16520. Lea, Robert N. 1973. FIRST RECORD OF THE SMOOTH ALLIGATORFISH, Anoplagonus inermis (FAMILY AGONIDAE), FROM CALIFORNIA WATERS. Calif. Fish and Game, 59(2): 142-144.

A smooth alligatorfish was collected August 15, 1972 at Arena Cove in northern California, some 360 miles south of the previous most southerly occurrence.

16521. Beyerle, George B. 1973. GROWTH AND SURVIVAL OF NORTHERN PIKE IN TWO SMALL LAKES CONTAINING SOFT-RAYED FISHES AS THE PRINCIPAL SOURCE OF FOOD. Mich. Dept. of Natural Resources, Fisheries Div., Fish. Res. Report No. 1793, 16 p.

Fingerling northern pike were stocked for 3 years in two small lakes, one containing only minnows and the other containing minnows and young coho salmon. Pike stocked at a rate of 46 fingerlings per acre, in 3 years produced mean standing crops of 52 pounds per acre. In the pike-minnow lake an adequate supply of small minnows throughout the study resulted in high survival of all year classes of pike. Moderate growth of pike occurred, but pike longer than 15 inches exhibited slow growth,, presumably because of a lack of larger food items. In the pike-minnow-salmon lake, survival of all three year classes of pike was relatively low, because very few small minnows were available to each year's crop of fingerling pike. However, the inclusion of salmon as a forage presumably increased the growth of larger pike to the extent that pike of age group II averaged 2.6 inches longer in the pike-minnow-salmon lake than in the pike-minnow lake. (Auth.)

16522. Matsusato, Toshiko. 1972. PRIMITIVE ERYTHOROPOESE IN EARLY DEVELOPMENT OF AMAGO Oncorhynchus rhodurus J., AND RAINBOW TROUT Salmo gairdnerii irideus G. Bull. Nansei Regional Fish. Res. Lab., No. 5 (Hiroshima, Japan); Fish Health News, 2(2): p. 13.

This report describes the earliest stages of hemopoiesis in two salmonids. Observations are supported by 23 good color photographs. The first signs of erythropoieses occurred in the yolk sac wall. The primitive erythrocytes and their nuclei are spherical, acidophilic and peroxydase positive. These erythrocytes increase in number until hatching and are gradually replaced by typical oval cells after hatching. As is evident from references cited, the latest non-Japanese paper referred to was published in 1955. -- S. F. Snieszko

16523. Stevens, J. D. (8 Courtenay Street, Salcombe, Devon, England). 1973. STOMACH CONTENTS OF THE BLUE SHARK (Prionace glauca L.) OFF SOUTHWEST ENGLAND. J. Mar. biol. Assoc. U.K., 53(2): 357-361.

Of 98 blue sharks examined from the Devon rod-and-line sport fishery, 61% were found to contain identifiable food remains. The main diet appears to consist of small pelagic fish and cephalopods, but at least some of the sharks had been feeding on the bottom. (Auth.)

16524. Snyder, George R., and Robert J. McConnell (Northwest Fish. Center, NMFS, NOAA, 2725 Montlake Blvd. East, Seattle, Washington 98102). 1973. FREQUENCY AND DURATION OF FLOW REVERSAL IN THE LOWER COLUMBIA RIVER, APRIL 1968 - MARCH 1970. NOAA Fishery Bulletin, 71(1): 312-314.

16525. Manuel, Dennis K., and Jerome V. Shireman (Univ. of Southwestern Louisiana, Lafayette, Louisiana). 1973. AGE, GROWTH, AND CONDITION FACTORS OF LARGEMOUTH BASS (Micropterus salmoides) IN A LOUISIANA COASTAL FRESHWATER MARSH. Institutional Research Series No. 17, Univ. of Southwestern Louisiana.

Age, growth rates, and condition factors were determined for 710 largemouth bass (Micropterus salmoides Lacépède) collected from the Big Burn Marsh, Cameron Parish, Louisiana. Scale examination revealed seven age groups present within the study area. Growth was slow through the first and second years when compared to other Louisiana areas. However, growth rates during the third, fourth, and fifth years were faster than growth rates reported in other Louisiana studies. Calculated K values for Big Burn bass indicate that these bass were in good relative condition, reflecting the productive nature of the study area. (Authors)

16526. Falk, M. R. (Canada Dept. of the Environ., Fish-Serv., Winnipeg, Manitoba, Canada). 1973. SIMPLE APPARATUS FOR CONDUCTING ACUTE TOXICITY BIOASSAYS UNDER FIELD CONDITIONS. Water Research, 7(6): 821-822.

The description and operation of apparatus for conducting acute toxicity bioassays in the field are given. The apparatus proved to be very satisfactory under field conditions being inexpensive, light and portable, as well as giving satisfactory results. (Auth.)

16527. Johnston, I. A., and G. Goldspink (Muscle Res. Lab., Dept. of Zool., Univ. of Hull, Hull, Yorkshire, England). 1973. SOME EFFECTS OF PROLONGED STARVATION ON THE METABOLISM OF THE RED AND WHITE MYOTOMAL MUSCLES OF THE PLAICE Pleuronectes platessa. Marine Biol., 19(4): 348-353.

The effect of starvation on glycogen, lipid, water content and muscle proteins of red and white muscles in the plaice Pleuronectes platessa L. has been investigated. The two muscle systems behave differently in their response to food shortage, glycogen and protein depletion being more marked in the white muscle. Little change occurred in the constituents of the red muscle, except lipid. Starvation resulted in an increase in water content in the white, but not in the red muscle. The differential response of these two muscle systems to starvation is discussed. It is suggested that the small amount of red muscle in the body is spared from the effects of starvation because it is needed for continuous activity during swimming at all speeds. (Authors)

16528. Moore, Stanley A., Jr., and Robert C. Harriss (Dept. of Oceanog., The Florida State Univ., Tallahassee, Florida 32306). 1972. EFFECTS OF POLYCHLORINATED BIPHENYL ON MARINE PHYTOPLANKTON COMMUNITIES. Nature 240: 356-358.

Bioassays were conducted in situ to determine short term effects of polychlorinated biphenyl compounds (PCBs) on natural marine phytoplankton communities. Levels of Aroclor 1242 and Aroclor 1254 as low as 1-2 μg/l (ppb) significantly inhibited photosynthetic fixation of bicarbonate. By contrast, p, p'-DDT inhibited carbon-14 uptake at 5 μg/l. Toxicity of 2,4'-dichlorobiphenyl, a component of Aroclor 1232, was comparable with p, p'-DDT. These results suggested that the toxic effects of PCBs might be more acute in situ at a community level than for single species laboratory cultures. (Authors)

16529. Cataudella, S., and E. Capanna (Ist. di Anat. Comp. dell'Univ. di Roma, Rome, Italy). 1973. CHROMOSOME COMPLEMENTS OF THREE SPECIES OF MUGILIDAE (PISCES, PERCIFORMES). Experientia, 29(4): 489-491.

Mugil cephalus L., Liza ramada (Risso), and Chelon labrosus (Risso) were studied in regard to chromosome complement. In all species the diploid number is 2n = 48; the chromosomes in all species are very small (varying between 2.5 and 1 μm) and acrocentric in shape. M. cephalus shows a karyotype with 24 pairs of acrocentric chromosomes, while L. ramada and C. labrosus are characterized by 1 pair of subtelocentric chromosomes. The findings are discussed in regard to classification of Mugilidae.

16530. Hoffert, J. Russell, and Paul O. Fromm (Dept. of Physiol., Mich. State Univ., East Lansing, Michigan 48823). 1973. EFFECT OF ACETAZOLAMIDE ON SOME HEMATOLOGICAL PARAMETERS AND OCULAR OXYGEN CONCENTRATION IN RAINBOW TROUT. Comp. Biochem. Physiol., 45(2A): 371-378.

Values for several hematological parameters are given for control and acetazolamide treated rainbow trout. Analyses of blood obtained 24 hr after acetazolamide treatment indicates that this carbonic anhydrase inhibitor had no effect on the O_2 dissociation curve for whole blood. Acetazolamide did cause an increase in red blood cell (RBC) volume and a significant decrease in the amount of oxygen carried per g of hemoglobin. The Root effect was observed in trout blood even in the presence of a pO_2 of 450 mm Hg and the absence of functional carbonic anhydrase. It was concluded that the rapid depletion of ocular pO_2 in trout eyes following acetazolamide treatment is not due to a decrease in the supply of oxygen to the counter current multiplier via the blood. (Authors)

16531. Popper, Arthur N., Michael Salmon, and Antares Parvulescu (Dept. of Zool., Univ. of Hawaii, Honolulu, Hawaii). 1973. SOUND LOCALIZATION BY THE HAWAIIAN SQUIRRELFISHES, Myripristis berndti AND M. argyromus. Anim. Behav., 21(1): 86-97.

Sound localization was investigated in a large pond open to a bay and similar to the normal environment of the animals. Observations were made of fish movements towards one of two underwater loud-speakers emitting squirrelfish alarm calls normally produced in response to predators. When the sound source was within 2.0 m of the test cage housing the fish, the subjects faced and moved toward the speaker. The animals responded some of the time when the source was within 3.0 m but generally did not orient to the sound source when the speaker was beyond 3.0 m. Response loss was correlated with the fish being in the acoustic far-field. Possible cues which release and direct localization remain unknown, but include particle velocity information alone, or some change in particle velocity: pressure relationships. (Authors)

16532. Hudson, Richard C. L. (Res. Unit for Comp. An. Resp., Univ. of Bristol, Bristol, England). 1973. ON THE FUNCTION OF THE WHITE MUSCLES IN TELEOSTS AT INTERMEDIATE SWIMMING SPEEDS. J. Exp. Biol., 58(2): 509-522.

The swimming performance of rainbow trout, Salmo gairdneri, and the electrical activities, recorded extracellularly, of its red and mosaic muscles have been studied at different swimming speeds. A linear relationship was found between the specific velocity (body lengths/sec) and the frequency of tail beating at frequencies up to 5/sec. The red muscles are active at all swimming speeds at which the fish swim by tail oscillations. Discharges from this muscle decrease in duration with frequency up to 3.5-5.0 beats/sec and then increase while the interburst interval decreases linearly with tail-beat frequency. Mosaic muscle becomes active at 3.05-3.60 tail beats/sec and increases slightly with increasing frequency of tail oscillations. Greatly increased activity was recorded in response to struggling and rapid accelerations. The white (mosaic) muscle mass of teleosts is concluded to be involved at intermediate swimming speeds and to be active at the higher range of cruising speeds. (Auth. summ.)

16533. Sekerak, Aaron D., and Hisao P. Arai (Pacific Biol. Sta., Nanaimo, British Columbia, Canada). 1973. HELMINTHS OF Sebastes alutus (PISCES: TELEOSTEI) FROM THE NORTHEASTERN PACIFIC. Canad. J. Zool., 51(4): 475-477.

Incidences and intensities of infection for 19 species of helminths recovered from Sebastes alutus are presented. Seven are regarded as new host records. Lecithophyllum anteroporum Margolis, 1958 is placed in synonymy with L. botryophorum (Olsson, 1868) Odhner, 1905. (Authors)

16534. Dizon, Andrew E., Ross M. Horrall, and Arthur D. Hasler. 1973. LONG-TERM OLFACTORY "MEMORY" IN COHO SALMON, Oncorhynchus kisutch. NOAA Fishery Bull., 71(1): 315-317.

16535. FAO of the United Nations (Rome, Italy). 1973. FAO AQUACULTURE BULLETIN. A QUARTERLY NEWS DIGEST OF AQUACULTURE RESEARCH AND DEVELOPMENT. FAO Aquacult. Bull., 5(2): 32 p., illus.

Text includes: From research institutions...Induced breeding of climbing perch - Induced breeding of murrel - Induced breeding of Clarias - Spawning of mullet and dolphin fish - Shrimp spawning in captivity - Rotifers as food for marine fish larvae - Rearing of turbot larvae - Genetic selection of common carp in the U.S.S.R. - Genetic selection of coho salmon - Polyculture of carps and tilapia - Polyculture of catfish-buffalo fish hybrid - Major carp culture in brackish water - Culture of baitfish - Fish culture in recirculating system - Fish nutrition - "phase" feeding of channel catfish - Demand-feeder - Fertilization of fish ponds - Control of mud-gas production in ponds - Temperature tolerance of grey mullet - Shrimp culture in Argentina - Shrimp culture in closed raceways - Commercial culture of marron (crayfish). Aquaculture development... Australia - Cameroon - Japan - Mexico - Nigeria - Norway - Pacific Islands (trust Territory) - South Africa - Sweden - United Kingdom - United States. Fish diseases and their control... Infectious pancreatic necrosis - Treatment of redmouth disease by oral bacterins - Control of whirling disease - Control of vibriosis - Furunculosis of chinook salmon in salt water - Exotic fish diseases in Italy 0 Tannin treatment for Chinese carp eggs - A new parasite in Australian oyster - Diseases of crayfish in Franch - "Black spot disease" of brown shrimps - American Fisheries Society establishes fish health section. Fish and shellfish introductions...Recent introductions - Introduced trout in Western Australia - Effect of pejerrey introduction in Lake Titicaca - Results of fish introductions in Europe - Policy on the introduction of exotic species. (From contents)

16536. Bertmar, G. (Dept. of Biol., Section of Ecol. Zool., Univ. of Umeå, Umea, Sweden). 1973. ULTRASTRUCTURE OF THE OLFACTORY MUCOSA IN THE HOMING BALTIC SEA TROUT Salmo trutta trutta. Marine Biol., 19(1): 74-88.

Scanning and transmission electron microscopy techniques have been used to study the olfactory organs of adult freshwater adapted Baltic sea trout Salmo trutta trutta L. homing back to the River Umeälven in Västerbotten, Sweden. Parr and smolt show only minor differences in comparison to the adult mucosa. All fish have polymorphism of receptors, supporting cells and basal cells, and a dynamic cell population with primary cells basally. These mature and die, and are either extruded or phagocytized. The mucosa has a remarkably large population of loose connective tissue cells (plasma cells, macrophages and lymphoid wandering cells) as well as all types of leucocytes. The olfactory organs of sea trout have labyrinth cells, a cell type unique for vertebrates. These cells probably help to maintain an optimal ion balance, which is of great ecological importance for this migrating species. The mucosa cilia have small tubercles arranged in a spiral pattern and correlated with transitional filaments from the 9 peripheral fibrils. A hypothesis on the relationship of primary supporting cells, primary nonsensory cells, immature fibroblasts and Schwann cells is presented. (Auth.)

16537. Toetz, Dale W. (Dept. of Zool., Okla. State Univ., Stillwater, Oklahoma 74074). 1973. THE LIMNOLOGY OF NITROGEN IN AN OKLAHOMA RESERVOIR: NITROGENASE ACTIVITY AND RELATED LIMNOLOGICAL FACTORS. Amer. Midl. Nat., 89(2): 369-380.

The surface waters of Lake Carl Blackwell, Oklahoma, were assayed, using acetylene reduction techniques, for their N_2 fixing potential at intervals of 2 to 3 weeks, between November 1969, and July 1971. Data were obtained on limnological factors which affect the rate of N_2 fixation; temperature, transparency of the water and concentration of nitrate, nitrite and ammonia at meter invervals. The ranges of the rates of ethylene production by concentrated and unconcentrated plankton were 0.1 to 225.6 and 50.6 to 185.4 nmoles (mg N hr)$^{-1}$, respectively. Rates fluctuated widely during the season and were nil in winter. Acetylene reduction at the surface was associated with the expanding phase of blooms of blue-green algae. Acetylene reduction by the sediments was also observed, and uptake of $^{15}N_2$ by the plankton verified that an N_2 fixing potential exists in the lake. Observations on the seasonal cycle of inorganic nitrogen revealed that nitrification predominated in

winter and early spring. Decreases in inorganic N in early summer at the surface were attributed to uptake by autotrophs. Mineralization proceeded after the demise of the autotrophs in autumn. During summer stagnation, nitrate, ammonia and nitrite were stratified, but there was no evidence of denitrification. (Auth.)

16538. Farmer, G. J., and F. W. H. Beamish (Dept. of Zool., Univ. of Guelph, Guelph, Ontario, Canada). 1973. SEA LAMPREY (Petromyzon marinus) PREDATION ON FRESHWATER TELEOSTS. J. Fish. Res. Bd. Canada, 30(5): 601-605.

The incidence of attack by the sea lamprey (Petromyzon marinus) was studied on freshwater teleosts of similar and different size. Splake (Salvelinus namaycush X Salvelinus fontinalis), carp (Cyprinus carpio), and white suckers (Catostomus commersoni) were attacked a significantly greater number of times than lake whitefish (Coregonus clupeaformis), burbot (Lota lota), shorthead redhorse suckers (Moxostoma macrolepidotum), and brown bullheads (Ictalurus nebulosus). Lampreys rarely preyed upon walleye (Stizostedion vitreum vitreum). Most attacks occurred between the head and caudal peduncle below the lateral line and particularly in the region behind the pectoral fins. Lampreys attached the largest individuals of any species more frequently than the smaller representatives. The presence of lampreys on a fish did not further the incidence of attack on that fish. None of the species of fish appeared to avoid lamprey attacks, nor did they avoid fish on which lampreys were attached. Only rarely were fish observed to dislodge lampreys. (Authors)

16539. Drachev, S. M. 1971. THE CHEMICAL COMPOSITION OF BOTTOM DEPOSITS AND FLOODED SOILS. (Khimicheskiĭ Sostav Donnykh Otlozheniĭ i Zatoplennykh Pochv). Abioticheskie Faktory Biologicheskogo Krugovorota v Vodoemakh, AN SSSR, Institut Biologii Vnutrennykh Vod, Trudy, No. 20(23): 3-7, Nauka, Leningrad; Translated by Robert M. Howland, available as SFWFR-TR-73-10.

The chemical composition of bottom suspensions, deposits and soils is analyzed and compared for Rybinskoe and Klyaz'minskoe Reservoirs.

16540. Eddy, F. B. (Res. Unit for Comp. An. Resp., Univ. of Bristol, Bristol, England). 1973. OXYGEN DISSOCIATION CURVES OF THE BLOOD OF THE TENCH, Tinca tinca. J. Exp. Biol., 58(2): 281-293.

Oxygen dissociation curves of tench (Tinca tinca) blood were constructed for fish which had been acclimated to 5, 13 or 20°C for at least 3 weeks. Compared to the blood of an active fish such as the rainbow trout tench blood has a high affinity for oxygen; at 13°C and a P_{CO_2} of 2-3 mm HG the blood was half saturated with oxygen at a P_{O_2} of 4 mm Hg. Increasing temperature, increasing P_{CO_2} and increasing hydrogen ion concentration decreased the oxygen affinity of the blood. At low temperatures the blood had an elevated pH value compared to blood at high temperatures. This is discussed in terms of the temperature dependence of ionization constants, in particular that of water. The Bohr effect and the factors influencing the loading and unloading tensions of oxygen in tench blood are discussed. The role of the blood in respiration and some properties of fish haemoglobins are also discussed. (Auth. summ.)

16541. Mackay, N. J. (School of Biol. Sci., Univ. of Sydney, Sydney, Australia). 1973. HISTOLOGICAL CHANGES IN THE OVARIES OF THE GOLDEN PERCH Plectroplites ambiguus, ASSOCIATED WITH THE REPRODUCTIVE CYCLE. Aust. J. Mar. Freshw. Res., 24(1): 95-101.

Histological changes in the ovary are described. P. ambiguus, a large freshwater serranid, requires the stimulus of a flood to trigger spawning. If a flood fails to occur, yolky oocytes become atretic and their contents are resorbed. New vitellogenesis commences immediately after spawning or in May-June if spawning fails to occur, and continues throughout the winter months. The possible significance of the unusual ovarian cycle of this species is discussed. (Auth.)

16542. Mayer, Foster L., Jr., and Robert H. Kramer (Bur. Sport Fish. & Wildl., Fish-Pesticide Res. Lab., Columbia, Missouri 65201). 1973. EFFECTS OF HATCHERY WATER REUSE ON RAINBOW TROUT METABOLISM. Progr. Fish-Cult., 35(1): 9-10.

Active and standard metabolic rates of rainbow trout (Salmo gairdneri) were determined after the fish were held for 306 days in seven consecutive water reuse troughs. Loading factors ranged from 0.45 to 3.15. Active metabolism was significantly reduced with each consecutive reuse, but standard metabolism did not appear to be affected. (Authors)

16543. Harris, J. E. (Dept. of Biol. Sci., Univ. of Exeter, Exeter, Devon, England). 1973. THE IMMUNE RESPONSES OF DACE Leuciscus leuciscus (L.) TO INJECTED ANTIGENIC MATERIALS. J. Fish Biol., 5(2): 261-276.

The fundamental features of the primary responses of dace Leuciscus leuciscus (L.), a freshwater cyprinid, to a number of standard antigens - haemocyanin, bovine serum albumin, horse serum, a bacterial antigen and an erythrocyte suspension, were examined. The fish were capable of producing either precipitating or agglutinating antibody in response to each of these antigens. Determinations of latent periods of antibody production by dace over a range of temperatures - 18, 10, 5 and 2° C, showed that although the latent periods of the primary response increased with decreasing temperature, fish were able to produce antibodies to the erythrocyte antigen at 2° C and to the Salmonella and horse serum protein antigens at 5° C. The demonstration of antibodies at 5 and 2° C suggests that the fish are capable of producing antibodies over the complete range of their normal environmental temperatures. (Auth.)

16544. Kelso, John R. M. (Dept. of Zool., Univ. of Manitoba, Winnipeg 19, Manitoba, Canada). 1973. SEASONAL ENERGY CHANGES IN WALLEYE AND THEIR DIET IN WEST BLUE LAKE, MANITOBA. Trans. Amer. Fish. Soc., 102(2): 363-368.

Seasonal changes in energy content of 500-600 cal/g occurred in whole walleye within a 1-year period. Energy content was lowest in spring and highest in fall. Seasonal changes in species, weight, and energy occurred among prey, but fish were the major diet contributors in terms of weight and energy. Gammarus lacustris appeared in all stomachs taken from walleyes but were minor nutrient contributors. Wide ranges in caloric values occurred within most taxa examined, and the importance of any taxon varied with the form of analysis, i.e., number versus calories. (Auth.)

16545. Valentine, David W., and Paul B. Samollow. 1973. A DEFORMED KELP BASS, Paralabrax clathratus (Girard), FROM ALIJOS ROCKS, BAJA CALIFORNIA. Calif. Fish and Game, 59(2): 148-151.

A deformity of the head and mouth of a kelp bass is described and illustrated. The specimen was collected near the southern range limit of the species.

16546. Dlugosz, Miroslawa (Wyzsza Szkola Rolnicza w Olsztynie, Wydzial Ochrony Wod i Rybactwa Srokladowego, Instytut Rybactwa Srodladowego). 1973. DEVELOPMENT OF BLOOD CELLS OF THE ERYTHROCYTIC AND LEUCOCYTIC SYSTEMS IN RAINBOW TROUT (Salmo gairdneri Richardson 1836) DURING THE PERIOD FROM CLOSING OF THE BLASTOPORE TO LARVAE HATCHING. Roczniki Nauk Rolniczych, 95(1): 25-39. (In English).

Results of investigations of blood cell development in rainbow trout at the final period of embryonic growth. The investigations were performed by histological-hematologic and cytochemical methods. It was discussed the developmental forms of blood cells of the erythrocytic and leucocytic systems stated during the investigated period. Observations of the embryos at successive days of development have been given in detail. (Auth. synopsis).

16547. Kusuda, Riichi, and Yukinori Takahashi. 1970. STUDIES ON THE SCALE PROTRUSION DISEASE OF CARP FISH. I. CHARACTERISTICS OF Aeromonas sp. ISOLATED FROM DISEASED FISH. Fish Pathology, 4(2): 87-97; Fish Health News, 2(2): p. 13, 1973. In Japanese.

16548. Jackim, Eugene (U.S. Environ. Protection Agency, Nat. Mar. Water Quality Lab., West Kingston, R. I. 02892). 1973. INFLUENCE OF LEAD AND OTHER METALS ON FISH δ-AMINOLEVULINATE DEHYDRASE ACTIVITY. J. Fish. Res. Bd. Canada, 30(4): 560-562.

Exposing mummichog (Fundulus heteroclitus) and winter flounder (Pseudopleuronectes americanus) to sublethal concentrations of lead resulted in reduction of liver and kidney δ-aminolevulinic acid dehydrase activity. The results of this project are expected to afford an index of response to heavy metals in estuarine waters. (Auth.)

16549. Stewart, Robert W., and J. Richard Trout. 1973. EVALUATION OF A VOLUNTARY ANGLER CREEL CENSUS PROCEDURE. N. J. Dept. of Environ. Protection, Div. of Fish, Game and Shellfisheries, Freshwater Fish. Lab., Lebanon, New Jersey Miscellaneous Report No. 38, 52 p.

The results (monthly catch rate by individual species) of a voluntary creel census, wherein anglers maintained records of their daily catch in log books that were returned to research project personnel at the end of the year, are compared with those obtained from an interview type census that utilized established procedures (Lambou, 1961). Information collected by both methods simultaneously for a total of four years, two years each at Spruce Run and Round Valley Reservoirs, was used as the basis for this evaluation. It was found that the strength of the linear relationship between log book and manned census techniques is greater at Round Valley than at Spruce Run. The strength of the relationship also varied greatly depending on the species being considered. It was found that at both lakes sunfish and trout demonstrated the strongest relationship. This is contrasted to largemouth and smallmouth bass, catfish and white perch for whom the relationships were found to be considerably weaker. This indicated that it would be infeasible to develop a single relationship between log book and manned census data which would be used for all species. It was observed that when the different sets of data that were collected for a given species were combined the results remained quite similar. In summary there is strong statistical evidence that, under circumstances similar to those existing during the term of this study, log book census information may be expected to give reasonably reliable estimates of manned census values for certain species. However, it must be emphasized that the strength of this reliability is dependent upon the particular species being considered as reflected in the confidence limits presented herein. (Authors)

16550. Apekin, V. S., and T. M. Tronina (Azov-Black Sea Inst. of Mar. Fish. and Oceanogr., Kiev, USSR). 1972. EXPERIMENTS ON STIMULATION OF MATURATION AND SPAWNING IN MULLET: PRELIMINARY RESULTS. Hydrobiological Journal, 8(1): 65-71.

The stimulating effect of fresh and acetonized striped mullet hypophyses and human chorionic gonadotropin on the maturation and ovulation of oocytes was studied in female striped mullet in stage 4 maturity, caught in the southern part of Kerch Strait. The administration of 4 fresh hypophyses induced complete maturation and ovulation of eggs in 6 of 13 females. Acetonized hypophyses and 500 and 100 IU of choriogonin stimulated maturation only slightly. Two or three fresh hypophyses induced maturation and spawning in mullet and golden mullet. (Authors)

16551. Kanid'ev, A. N., and Yu. I. Romanenko (VNIIPRKh, USSR). 1973. COMPUTER CALCULATION OF OPTIMAL RATIONS FOR THE RAINBOW TROUT (Raschet na EVM Optimal'nykh Ratsionov dlya Raduzhnoĭ Foreli). Rybnoe Khozyaĭstvo No. 3, pp. 26-29. In Russian.

A computer method is described for selection of optimal ingredients for rainbow trout rations. The rapid method permits one to make correct selection of ingredients of a food mixture in accordance with the biological and economic conditions of the feeds and, secondly, in the absence of some or other ingredients to make a rapid substitution for the missing components and conversion of the food mixture, having retained its nutritive value.

16552. Iuchi, Ichiro (Zool. Inst., Fac. of Sci., Univ. of Tokyo, Tokyo, Japan). 1973. THE POST-HATCHING TRANSITION OF ERYTHROCYTES FROM LARVAL TO ADULT TYPE IN THE RAINBOW TROUT, Salmo gairdnerii irideus. J. Exp. Zool., 184(3): 383-396. In English.

In addition to typical, round disc-like larval type erythrocytes (erythrocyte L) in pre-hatching embryos as well as just-hatched larva and the typical elliptic disc-like adult type erythrocytes (erythrocyte A) in two-year-old fish, a third type of erythrocytes has been observed to appear in the peripheral blood of rainbow trout larvae during a short period (a few weeks) of erythrocyte transition from L to A. Analyses of the erythrocyte population at various stages of the transition have suggested that the third type erythrocytes may not be derived from erythrocyte L, but may be an independent population which will develop into erythrocyte A in the blood and therefore have been referred to as immature type erythrocyte A (erythrocyte ImA). Dynamics of erythrocyte replacement from one to the others during post-hatching development is characterized by the rapid decrease in erythrocyte L and the compensatory appearance of erythrocyte ImA, which then will develop into the mature erythrocyte A in the peripheral blood. The three types of erythrocytes differ with respect to sensitivity to osmotic shock. A difference has also been observed between erythrocyte L and erythrocyte A including ImA concerning reactivity with concanavalin A and wheat germ agglutinin. (Auth.)

16553. U. S. Department of Commerce, NOAA, NMFS (Seattle, Washington). 1973. OCEAN FISHERY MANAGEMENT: DISCUSSIONS AND RESEARCH. NOAA Technical Report NMFS CIRC-371, 173 p., Adam A. Sokoloski, Editor.

16554. Poddubnyi, A. G., L. K. Malinin, and V. V. Gaiduk. 1971. BEHAVIOR OF ATLANTIC SALMON (Salmo salar L.) UNDER CONDITIONS OF ARTIFICIAL INTERFERENCE FROM THE NIZHNE TULOMA HYDROELECTRIC POWER PLANT. Biol Vnutr Vod Inf Byull., 10, pp. 56-61; Selected Water Resources Abstracts, 6(11): p. 66.

Behavior of Atlantic salmon in the dam area was substantially affected by the work regime of the hydroelectric power station. The greatest entry of fish into the fish station was observed during the morning and evening at the beginning of ebb and flood tides, when the water level was 1-2 m below maximum. -- Biological Abstracts, Inc.

16555. Khalturin, D. K., and L. P. Ryzhkov (White Sea Biol. Stat. of the Zool. Inst., USSR Acad. of Sciences and Northern Lake and River Fish. Res. Inst. (SevNIORKh). 1972. ECOLOGICAL ANALYSIS OF FAT CONTENT DYNAMICS IN THE SEA TROUT [Salmo trutta (L.)]. J. Ichthyol., 12(1): 122-129.

Observations on the sea trout of the Tikshozero Basin made in the period June-October have revealed the magnitude and variability of the fat content of its flesh in relation to the time and place of catching, the size of the fish and the rate of maturation. The fat content of the autumn sea trout is not inferior to that of the Atlantic salmon, the Baltic salmon and the Ladoga salmon. Sea trout from September catches in the western part of the White Sea were distinguished by higher fat content than the lake form.

16556. Sundbäck, Klaus, and Arja Lindholm (Riista- ja kalatalouden tutkimuslaitos, kalantutkimusosasto, os. Pitkansillanranta 1 A, 00530 H:ki 53). 1972. PUBLICATIONS OF THE BUREAU FOR FISHERIES INVESTIGATIONS BOARD OF AGRICULTURE 1.1.1924 - 28.2.1971 (Maataloushallituksen Kalataloudellisen Tutkimustoimiston Julkaisuja 1.1.1924 - 28.2.1971). Riista- ja Kalatalouden Tutkimuslaitos kalantutkimusosasto, tiedonantoja 1(2): 115-241. In Finnish.

This list of literature contains 1487 references to publications and articles from the Bureau for Fisheries Investigations, Board of Agriculture.

16557. Whitmore, Donald H., and Erwin Goldberg (Dept. Biol. Sci., Northwest Univ., Evanston, Illinois). 1972. TROUT INTESTINAL ALKALINE PHOSPHATASES. I. PHYSICAL-CHEMICAL CHARACTERISTICS. Chemical Abstracts, 77(25), 161422 u; Marine Fisheries Abstracts, 26(6): p. 2, 1973.

16558. Hines, R., and D. Spira (Fish and Aquaculture Sta., Dor, D.N. Hof HaCarmel, Israel). 1973. ACQUIRED IMMUNITY OF MIRROR CARP (Cyprinus carpio L.) TO ICHTHYOPHTHIRIASIS. Refuah Vet., 30(1): 17-19.

Mirror carp, infected with measured sublethal doses of Ichthyophthirius multifiliis at 18-20°C were free of parasites 21 days after infection. The fish remained free of parasites for at least 8 months although constantly exposed to infective stages of the parasite. Such fish were refractory to reinfection even with numbers of parasites that killed all normal, previously unexposed fish. Serum from fish that recovered from previous infection with sublethal doses of the parasites immobilized free swimming stages of I. multifiliis to a dilution of 1:1024. The barrier to infection in immune fish apparently operates at the level of the mucous covering of the body and is due to some qualitative change in the mucus. (Authors)

16559. Schwartz, Joseph J. (Iowa Coop. Fish. Unit, Iowa State Univ., Ames, Iowa). 1973. A POST-EPIZOOTIC SEARCH FOR FURUNCULOSIS IN A WARM-WATER FISH POPULATION. J. Wildlife Diseases, 9(2): 106-110.

Specimens were taken from the kidneys of 777 fish of 10 species from Clear Lake, Iowa, in 1970 and 1971 to determine the carrier rate of Aeromonas salmonicida after a 1968 furunculosis epizootic that destroyed most of the yellow bass population. A. salmonicida was not detected in any fish examined. Serum from 5 of 46 yellow bass old enough to have been present during the 1968 epizootic contained agglutinins to A. salmonicida. (Auth.)

16560. Peden, Alex E. (Dept. of Zool., The Univ. of Texas at Austin, Texas). 1973. VIRTUAL EXTINCTION OF Gambusia amistadensis n. sp., A POECILIID FISH FROM TEXAS. Copeia No. 2, pp. 210-221.

Gambusia amistadensis n. sp. is described from Goodenough Spring which flowed into the Rio Grande in Val Verde, County, Texas. It is related to the G. gaigei, G. alvarezi and G. hurtadoi complex of the nobilis species group but differs from these species in being more slender, having a more terminal mouth with more teeth on each jaw and males having longer serrae on gonopodial ray 4p. The new species is also related to, but differs from, G. senilis in that males have fewer segments in the elbow of gonopodial ray 4a and females have a permanent median dark anal spot. The newly constructed (1968) Amistad Reservoir on the Rio Grande has inundated Goodenough Spring with more than 30 meters of water. Although some individuals from this population survive in artificial ponds and aquaria, the indigenous stock of G. amistadensis is presumably extinct. (Auth.)

16561. Mathur, Dilip (Ala. Coop. Fish. Unit, Auburn Univ., Auburn, Alabama 36830). 1973. SOME ASPECTS OF LIFE HISTORY OF THE BLACKBANDED DARTER, Percina nigrofasciata (Agassiz), IN HALAWAKEE CREEK, ALABAMA. Amer. Midl. Nat., 89(2): 381-393.

Specimens of Percina nigrofasciata were collected from February 1970 to March 1971 in Halawakee Creek, Lee Co., Alabama (Apalachicola River system), over several substrate types, but most commonly over gravel. Collections included representatives of 32 species, only 13 of which were strongly associated with P. nigrofasciata. Preference for gravel was substantiated by laboratory experiments. Sexual dimorphism and dichromatism were distinct. Melanophore pattern changed in response to the background color. Females dominated in size group less than 60 mm TL and males dominated in size group greater than 60 mm TL. Maturity estimates were based on diameters of developing ova. Two sets of maturing ova were present, but only one spawning occurred. Spawning season extended from early May to June. Egg number was related exponentially to the fish length. Weight of the fish and egg number were linearly related. Length of fish and diameter of ova were not correlated. Length-weight regression lines of males and females differed only in their elevations (adjusted means). In both sexes weight increased significantly more than the cube of the length. (Auth.)

16562. Drabkina, B. M., and M. A. Vodovozova (Azerbaijan Div., Central Inst. of Lake and River Fisheries, Baku, USSR). 1972. EFFECT OF PRESSURE WAVES ON THE MORPHOLOGY OF FISH BLOOD. Hydrobiological Journal, 8(1): 77-78.

16563. Fried, Stephen M., and James D. McCleave (Dept. of Zool., Univ. of Maine, Orono, Maine 04473). 1973. OCCURRENCE OF THE SHORTNOSE STURGEON (Acipenser brevirostrum), AN ENDANGERED SPECIES, IN MONTSWEAG BAY, MAINE. J. Fish. Res. Bd. Canada, 30(4): 563-564.

Thirty-one shortnose sturgeon (Acipenser brevirostrum) were caught in gillnets in Montsweag Bay in the Sheepscot River system during June and July of 1971 and 1972. Of nine fish preserved for study, six were longer than any previously documented and four exceeded the maximum total length previously postulated. These specimens represent the second population of this endangered species found in the Gulf of Maine. (Authors)

16564. Hurley, Donal A. (Ont. Ministry of Nat. Resources, Research Branch, Maple, Ontario, Canada). 1973. THE COMMERCIAL FISHERY FOR AMERICAN EEL, Anguilla rostrata (Lesueur), IN LAKE ONTARIO. Trans. Amer. Fish. Soc., 102(2): 369-377.

Commercial fishermen thought the eel fishery in Lake Ontario was threatened by increased fishing pressure and the Moses-Saunders hydroelectric dam in the upper St. Lawrence River. The catch declined from 1959 through 1970 in some areas of the lake, but catch per unit of effort generally remained constant, mainly because effort decreased. Setlines, hoopnets, and trapnets are all used in the fishery. Samples of eels from the fishery examined each year from 1964 through 1971 showed that hoopnets caught the largest eels and setlines, the smallest; the average length of eels decreased from 1964-1965 values; and the number of eels in the 900 and 1000-mm length classes declined sharply after 1964, but increased in the 500, 600, 700-mm classes. Decrease in average size of eels was almost certainly the result of increased fishing pressure; effort, especially in the setline fishery, fluctuated rapidly in response to changing levels of catch. The Moses-Saunders dam has not been a complete barrier to the migration of eels into Lake Ontario, but the way they bypass the dam is not known. (Auth.)

16565. Knaggs, Eric H., and Richard H. Parrish. 1973. MATURATION AND GROWTH OF PACIFIC MACKEREL Scomber japonicus Houttuyn. Calif. Fish and Game, 59(2): 114-120.

The maturation of Pacific mackerel has never been documented clearly. Analysis of data reveals spawning can occur from March through October, but the majority takes place from April through August. During this April through August period, 22.5%, 65.7%, 75.1%, 84.7%, 84.2%, and 87.5% of the female fish were mature or maturing for Age Groups I, II, III, IV, V, and VI+ respectively. A von Bertalanffy growth curve and a weight-length curve were calculated. The weight-length curve differed significantly from a curve previously published. (Authors)

16566. Buck, D. Homer, Richard J. Baur, and C. Russell Rose (Ill. Natural History Survey, Urbana, Illinois 61801). 1973. AN EXPERIMENT IN THE MIXED CULTURE OF CHANNEL CATFISH AND LARGEMOUTH BASS. Prog. Fish-Cult., 35(1): 19-21.

Consideration is given to the practicability for the combined culture of largemouth bass (Micropterus salmoides)and channel catfish (Ictalurus punctatus) in sub-adult sizes. Bass trained to accept pelleted food were stocked both alone and in combination with channel catfish in outdoor, unshaded, 10-foot-diameter plastic pools having soil substrates. Over a 70-day feeding period the catfish made the better gains, but the two species appeared to be completely compatible with neither limiting the production of the other. (Authors)

16567. Wolf, Ken, and M. C. Quimby (Eastern Fish Dis. Lab., Kearneysville, West Virginia). 1973. TOWARDS A PRACTICAL FAIL-SAFE SYSTEM OF MANAGING POIKILOTHERMIC VERTEBRATE CELL LINES IN CULTURE. In Vitro, 8: 316-321; Fish Health News, 2(2): p. 16.

A series of thirteen integrated precepts is used in a system for managing continuous laboratory propagation of poikilothermic vertebrate cell lines. The precepts are listed in sequence of application and discussed. (Authors)

16568. Hunt, P. C., and K. O'Hara (Dept. of Zool., Univ. of Liverpool, England) 1973. OVERWINTER FEEDING IN RAINBOW TROUT. J. Fish Biol., 5(2): 277-280.

The contents of the stomachs of 38 rainbow trout stocked in Llyn Alaw, Anglesey in August 1969 and caught between October 1969 and February 1970 were analysed. The fish were actively feeding on the bottom fauna throughout the winter and 21 of the stomachs were full or distended. The mean volume of the contents of the stomachs was 2.8 times greater than that of the contents of stomachs of similarly sized brown trout caught at the same time. (Authors)

16569. Beamish, Richard J. (Dept. of the Environ., Fish. Res. Bd. of Canada, Freshwater Inst., Winnipeg, Manitoba R3T 2N6, Canada). 1973. DETERMINATION OF AGE AND GROWTH OF POPULATIONS OF THE WHITE SUCKER (Catostomus commersoni) EXHIBITING A WIDE RANGE IN SIZE AT MATURITY. J. Fish. Res. Bd. Canada, 30(5): 607-616.

The use of the scale method to determine age of mature white suckers should be avoided. Sections of pectoral fin rays can provide accurate age determinations for most populations once the position of the first annulus has been identified. The age of immature white suckers can be estimated by both methods. It is suggested that, for identification of the first fin ray annulus and facility in the determination of the age of immature white suckers, both pectoral fins and scales should be sampled in all age and growth studies of this species. White suckers (Catostomus commersoni) from populations examined in this study attained ages of up to 17 years although little or no growth occurred in the latter years. Considerable variation in size at sexual maturity was found throughout the range for this species and, thus, the validity of a subspecies designation for a dwarf white sucker (C. c. utawana) based primarily on size differences should be reexamined. (Auth.)

16570. Gasowska, Matylda (Polska Akademia Nauk, Instytut Zoologiczny, Warszawa, Poland). 1973. COMPARATIVE AND BIOMETRIC STUDIES OF THE Coregonus albula (Linnaeus 1758), (PISCES, COREGONINAE) FROM THE LAKES OF POLAND AND A FEW NEIGHBOURING COUNTRIES. [Porownawcze, Biometryczne studia sielawy (Coregonus albula [Linnaeus 1758]) (Pisces, Coregoninae) z jezior polski i niektorych krajow osciennych]. Roczniki Nauk Rolniczych, 95(1): 41-54. In Polish with English synopsis.

Results of biometric studies of Coregonus albula (Linnaeus 1758) from five chosen lakes of Poland. The study of fitness of 2 characters adopted by Smitt [22] as taxonomic criteria for differentiation of C. albula from C. sardinella: the predorsal space, and the space between ventral and anal fins (V-A). Stating of essential influence exerted upon C. albula by the biotope. In effect of this the fish populations evolved in separate water bodies are specific for the lake. (Auth. synopsis).

16571. Rafail, S. Z. (Inst. of Oceanogr. and Fish., Kayed Bey, Alexandria, Egypt). 1973. A SIMPLE AND PRECISE METHOD FOR FITTING A VON BERTALANFFY GROWTH CURVE. Marine Biology, 19(4): 354-358.

The parameter K of the von Bertalanffy equation, as developed by Beverton and Holt (1957), is first estimated by the relation $\log_e (dL_t/dt) = A - Kt$, where dL_t/dt denotes growth increments per a unit of age, t denotes age, and A is a constant. The K estimate is used to evaluate L_{oo};

$$L_{oo} = e^k \left(\sum_{2}^{n} Lt - \sum_{1}^{n-1} Lt \right) / (n-1)(e^k - 1).$$

The L_{oo} estimate is used to estimate t_o, and to obtain a better estimate for K; $\log_e (1 - Lt/L_{oo}) = - Kt + Kt_o$. The K estimate may be used to obtain another estimate for L_{oo}. Solved examples show that a single iteration is sufficient to obtain fitted equations which are, on the average, as precise as equations fitted by the least squares method shown by Tomlinson and Abramson (1961). This new method can be used, with a slight modification, for the second equation given above, if growth data have unequal age intervals. The variance of K, t_o and $\log_e L_{oo}$ can be estimated by applying the simple methods used in the case of straight-line relationships (Auth.)

16572. Freeman, H. C., and D. A. Horne (Fish. Res. Bd. of Canada, Halifax Lab., Halifax, Nova Scotia, Canada). 1973. TOTAL MERCURY AND METHYLMERCURY CONTENT OF THE AMERICAN EEL (Anguilla rostrata). J. Fish. Res. Bd. Canada, 30(3): 454-456.

In American eels (Anguilla rostrata) caught in Nova Scotia, the total mercury content was found to be 0.72 ± 0.05 ppm and the methylmercury content was 0.40 ± 0.06 ppm (mean ± SE for 23 fish). Since the mean total mercury content was less than 1 ppm and the toxic methylmercury content was 50% of this, or less than the 0.5 ppm guideline, such eels may be acceptable for human consumption. (Authors)

16573. Ellefson, Paul V., and Gale C. Jamsen (Mich. Dept. of Natural Resources, Lansing, Michigan 48926). 1971. ECONOMIC APPRAISAL OF MICHIGAN'S SPORT FISHERY, JANUARY 1 - APRIL 24. Mich. Dept. Nat. Res., Research and Development Report 227, 36 p.

Fishermen in Michigan were estimated to have spent 185,000 days fishing exclusively for salmon and steelhead in Michigan from January 1 - April 24, 1970. The net economic value of this fishing is estimated to be $587,600. Salmon and steelhead fishing on Lake Michigan and its tributaries accounted for 40 percent ($237,400) of the total value. The net economic value of all other fishing for the same period is estimated to be $5.1 million. (Authors)

16574. Czeczuga, B. (Dept. of Gen. Biol., Biological-Morphological Inst., Bialystok Med. Acad., Bialystok, Poland). 1973. CAROTENOIDS IN FISH. II. CAROTENOIDS AND VITAMIN A IN SOME FISHES FROM THE COASTAL REGION OF THE BLACK SEA. Hydrobiologia, 41(1): 113-125.

The presence of various carotenoids and vitamin A in seven species of fish from the coastal region of the Black Sea was investigated by means of columnar and thinlayer chromatography. The investigations revealed the presence of the following carotenoids: Mugil auratus: β-carotene, canthaxanthin, lutein, zeaxanthin, astaxanthin ester and astacene; Diplodus annularis: β-carotene, canthaxanthin, tunaxanthin, lutein, zeaxanthin and astacene; Diplodus sargus: β-carotene, tunaxanthin, lutein, taraxanthin, zeaxanthin and astaxanthin; Crenilabrus tinca: tunaxanthin, canthaxanthin, lutein, astaxanthin, and astacene; Blennius sphinx: β-carotene, x-carotene (?), lutein, tunaxanthin, taraxanthin and astaxanthin; Blennius sanguinoleutus: β-carotene, tunaxanthin and astaxanthin (ester and free); Gobius melanostomus: β-carotene and astacene. Some fractions were not identified. Vitamin A was found in all species investigated. (Auth.)

16575. Benziger, David, and Bruce L. Umminger (Dept. of Biol. Sci., Univ. of Cincinnati, Cincinnati, Ohio). 1973. ROLE OF HEPATIC GLYCOGENOLYTIC ENZYMES IN THE COLD-INDUCED HYPERGLYCEMIA OF THE KILLIFISH, Fundulus heteroclitus. Comp. Biochem. and Physiol., 45(3A): 767-772.

The concentration of serum glucose and the specific activities of hepatic glycogen phosphorylase and glucose-6-phosphatase were examined in salt-water-adapted killifish acclimated to 20°C and to -1.5°C for 1 and 10 days. Exposure to subzero temperatures produced a hyperglycemia accompanied by an increase in the activity of glycogen phosphorylase and no change in the activity of glucose-6-phosphatase. Killifish dying in the subzero cold showed no elevation of serum glucose levels and a decrease in the activities of both glycogen phosphorylase and glucose-6-phosphatase. (Authors)

16576. Sick, K., O. Frydenberg, and J. T. Nielsen (Inst. of Genetics, Univ. of Copenhagen, Copenhagen, Denmark). 1973. HAEMOGLOBIN PATTERNS OF SECOND-GENERATION HYBRIDS BETWEEN PLAICE AND FLOUNDER. Heredity, 30(2): 244-245.

Haemoglobin electrophoresis of F_2 hybrids between plaice and flounder revealed besides the parent and F_1 patterns only one new pattern, which is most likely due to trisomy or triploidy. (Authors' summ.)

16577. Bryan, J. E. (Dept. of Zool., Univ. of British Columbia, Vancouver, British Columbia, Canada). 1973. FEEDING HISTORY, PARENTAL STOCK, AND FOOD SELECTION IN RAINBOW TROUT. Behaviour, 45(1-2): 123-153.

Feeding history and parental stock were manipulated to determine whether they could influence food selection in young trout, Salmo gairdneri Richardson. After 9 training meals of one food, trout selected that food, the familiar one, when given a choice between it and a novel food. (Most choice situations used high and equal densities of unconcealed foods). Selection of the familiar food occurred with several kinds of non-living food. Trout trained on live prey, however, did not always select the familiar one when both prey were alive, although they did when both prey were dead. Some characteristics of the training effect were investigated. As they became satiated, trout consumed relatively more of the novel food. Duration of food deprivation before a choice test did not change the degree of selection for the familiar food. In addition to eating more of the familiar food, trout struck but rejected relatively more of the novel food. Individual trout trained on two foods ate them in proportions which were characteristic for an individual. After they had learned to select one food, trout were given further training on one of the following: the familiar food, a novel food, or both. Further training on the familiar food did not change the proportion selected. Trout trained on one food for 12 meals and then on a second food for 12 meals selected the second food when given a choice. When the initial training was followed by continuous feeding of both familiar and novel food, trout continued to select the familiar food for 14 to 23 meals. All results suggested that effects of such feeding history would not greatly influence food selection in natural situations. Progeny of different parental stocks were tested to determine whether parental food can influence food selected by offspring. Eggs from trout which ate different kinds of food were hatched in the laboratory. For their first meal, trout were given choices of the kinds of food eaten by parental stocks. In three main experiments, the young trout did not select the type of food commonly eaten by their parents. (Auth. summ.)

16578. Funk, James D., Edward M. Donaldson, and Helen M. Dye (Fish. Res. Bd. of Canada, West Vancouver, British Columbia, Canada). 1973. INDUCTION OF PRECOCIOUS SEXUAL DEVELOPMENT IN FEMALE PINK SALMON (Oncorhychus gorbuscha). Canad. J. Zool., 51(5): 493-500.

Acceleration of ovarian maturation was achieved in immature pink salmon (Oncorhynchus gorbuscha) with injections of chinook (spring) salmon (Oncorhynchus tshawytscha) gonadotropin alone, and in combination with estradiol 17β. Oocytes containing yolk globules were evident in fish treated three times per week with 1.0 μg/g body weight salmon gonadotropin in combination with 1.5 μg/g body weight estradiol 17β for 126 days. After 168 days they were also seen in salmon treated with the same dosage of salmon gonadotropin alone. Estradiol 17β alone, at a dosage of 15 μg/g body weight, or in combination with salmon gonadotropin, inhibited vitellogenesis. Formation of oocytes 2 mm in diameter required 7-1/2 months of treatment with 1.0 μg/g body weight salmon gonadotropin in combination with 1.5 μg/g body weight estradiol 17β, and 9 months of injections with 1.0 μg/g body weight gonadotropin alone. Few large yolky oocytes were developed by any of the treatments. Large numbers of preovulatory corpora atretica were observed in all treated fish. Only a small amount of histochemically demonstrable $\triangle^{5}$-3β hydroxysteroid dehydrogenase activity was present in ovaries from pink or chinook salmon juveniles treated for 3 months with various dosages of salmon gonadotropin. (Authors)

16579. Bullock, Theodore Holmes (Scripps Inst. of Oceanogr., Univ. of Calif., San Diego, California). 1973. SEEING THE WORLD THROUGH A NEW SENSE: ELECTRORECEPTION IN FISH. American Scientist, 61(3): 316-325.

Sharks, catfish and electric fish use low- or high-frequency electroreceptors, actively and passively, in object detection and social communication.

16580. Walters, K. W., Jr., and L. S. Smith (Fish. Res. Inst., Univ. of Washington, Seattle, Washington). 1973. RESPIRATORY DYNAMICS OF THE STARRY FLOUNDER Platichthys stellatus IN RESPONSE TO LOW OXYGEN AND HIGH TEMPERATURE. Marine Biology, 19(2): 133-148.

Starry flounder (Platichthys stellatus Pallas) were fitted with masks for measurements of ventilation volume and post-gill oxygen tensions, and with arterial and venous cannulae. They were then subjected to periods of low oxygen levels and high temperature. Pre- and post-gill oxygen tension, blood oxygen tension and content, oxygen uptake, and ventilation volume were measured. Effectiveness of gas exchange across the gills, cardiac output, and transfer factor were calculated. A series of blood-oxygen dissociation curves were also constructed at two pH's and temperatures. The data suggest that flounder are able to regulate oxygen uptake down to an environmental oxygen tension of at least 50 mm Hg by increasing ventilation volume and transfer factor while not changing blood flow rate or pattern. Also, the flounder's response to temperature increase is similar to the expected response to exercise, with the exception of an increase in gill diffusion resistance. (Authors)

16581. Colgan, Patrick (Section of Neurobiol. and Behav., Div. of Biol. Sci., Cornell Univ., Ithaca, New York). 1973. MOTIVATIONAL ANALYSIS OF FISH FEEDING. Behaviour, 45(1-2): 38-66.

Problems and approaches in the analysis of the motivation (internal stimuli) of animal behaviour are reviewed and the nature and advantages of stimulus-response models in dealing with complex cases are discussed. The data on the motivation of fish feeding are reviewed by considering the topics of homeostasis, deprivation and satiation, systemic need versus gastric volume, and preference and selectivity. Based on these observations, a tentative model is proposed. It is shown that the model clarifies several points in the literature and predicts certain response relations present, but apparently unrealized, in the published data. Further, the model makes a number of untested predictions. Some of these predictions were tested and confirmed in a controlled experiment involving pumpkinseed sunfish (Lepomis gibbosus), in individual aquaria, fed in a standard Latin square design with added control conditions. The modelling approach, traditional drive theory, and the case study of fish hunger were used to develop a rigorous general definition of "drive" based on stimulus-invariant response relations. (Auth. summ. in part)

16582. Alt, Kenneth T. (Alaska Dept. of Fish and Game, Div. of Sport Fish, Fairbanks, Alaska 99701). 1973. AGE AND GROWTH OF THE INCONNU (Stenodus leucichthys) IN ALASKA. J. Fish. Res. Bd. Canada, 30(3): 457-459.

Studies of three anadromous groups (Kuskokwim River, lower Yukon River, Kobuk-Selawik area) and two fluvial groups (upper Yukon River and Minto Flats) of inconnu (Stenodus leucichthys) showed Kuskokwim River fish to be the fastest growing, reaching 81 cm in 10 years. Fish from the slower-growing Kobuk-Selawik samples attained weights over 20 kg and lengths of 110 cm while fish over 12 kg and 100 cm were uncommon from other waters. Females in all groups studied lived longer than males. Age at sexual maturity ranged from 5 to 9 years for males and 7 to 12 years for females. (Auth.)

16583. Hayes, Lyle W., Ian J. Tinsley and Robert R. Lowry (Dept. of Agric. Chem., Oregon State Univ., Corvallis, Oregon). 1973. UTILIZATION OF FATTY ACIDS BY THE DEVELOPING STEELHEAD SAC-FRY, Salmo gairdneri. Comp. Biochem. Physiol., 45(3B): 695-707.

The fatty acid content of both the yolk and the steelhead sac-fry, Salmo gairdneri, has been studied during development. Losses of individual fatty acids from the yolk were proportional to the mass of the particular fatty acid present and only 18:1 showed any tendency to be retained in this compartment. After hatching the fatty acid composition of the sac-fry was distinct from that of the yolk. Certain fatty acids, 16:0, 18:0 and 22:6, were preferentially retained in the sac-fry lipids. Other fatty acids, 16:1, 18:1, 20:1 and 22:5, were retained to a much smaller extent considering the quantities available. It is suggested that 22:6 plays a special role in the fatty acid metabolism of the fish. (Authors)

16584. Jude, David J. (Iowa Coop. Fish. Unit, Iowa State Univ., Ames, Iowa 50010). 1973. FOOD AND FEEDING HABITS OF GIZZARD SHAD IN POOL 19, MISSISSIPPI RIVER. Trans. Amer. Fish. Soc., 102(2): 378-383.

Examination of 344 of 1,368 gizzard shad captured mainly with gill nets during 1966-67 showed that intensive feeding began in April or early May and ended by early September. There appeared to be little correlation between diurnal activity and food consumption. Fingernail clams (Sphaeriidae), sand and unidentified material were the most abundant items found in larger gizzard shad. Larger shad captured in open waters consumed a larger percentage of bottom organisms, particularly fingernail clams, than did smaller shad. Comparison of numbers of fingernail clams (less than 5 mm long) in bottom samples versus volume of sphaeriids consumed by shad in the same areas revealed greater consumption in open water habitat where clam populations were highest. A significant weight difference at a given length was found between shad captured during summer from shallow water versus those from open water habitat, presumedly correlated with feeding habits. (Auth.)

16585. Sick, Lowell V., David White, and Garry Baptist (Skidaway Inst. of Oceanogr., Savannah, Goergia 31406). 1973. THE EFFECT OF DURATION OF FEEDING, AMOUNT OF FOOD, LIGHT INTENSITY, AND ANIMAL SIZE ON RATE OF INGESTION OF PELLETED FOOD BY JUVENILE PENAEID SHRIMP. Prog. Fish-Cult., 35(1): 22-26.

Rates of pelleted formula diet ingestion (milligrams food ingested per gram animal dry weight per hour) were determined for different size juvenile shrimp (Penaeus setiferus) (2-4 g, 5-7 g, and 15-20 g) fed at 10, 20, and 30% of their total biomass, for feeding periods of 6, 12, and 24 hours and under light intensities of 1.6, 250, and 1100 ft-c. These interactions, tested using two 3 x 3 x 3 factorially designed randomized complete block experiments, revealed that the highest average rate of ingestion (5.9) occurred among animals fed 10% of their total biomass under 1100 ft-c of light and exposed to the same food for only 6 hrs. Comparing animal size, light intensity, and period of exposure to the same food revealed that rates of ingestion increased with increases in light intensity, decreased with animal size (on a unit weight basis), and decreased with an increase in period of exposure to the same food. In a second experiment comparing animal size, light intensity, and amount of food, rates of food ingestion for differences in animal size and light intensity were the same as in experiment 1. Ingestion rates did not change with increases in amounts of food fed above 10% of total biomass. (Authors)

16586. Carline, Robert F., and James D. Hall (Dept. of Fish. & Wildl., Oregon State Univ., Corvallis, Oregon 97331). 1973. EVALUATION OF A METHOD FOR ESTIMATING FOOD CONSUMPTION RATES OF FISH. J. Fish. Res. Bd. Canada, 30(5): 623-629.

A method of estimating food consumption rates of fish in nature from laboratory growth data was evaluated using juvenile coho salmon (Oncorhynchus kisutch) in three similar experiments. One group of coho was held individually in aquariums where movement was restricted. Another group was maintained in an experimental stream where the coho displayed many of their typical behavior patterns. All fish were fed known rations and both groups had similar growth efficiencies over a wide range of rations. Coho feeding at intermediate rates had the highest gross efficiencies. Aggressive activity did not affect growth efficiency. Results suggested that laboratory food and growth data may provide reasonably accurate estimates of food consumption of coho salmon in nature. (Authors)

16587. Menzel, Bruce W., and Rezneat M. Darnell (Dept. of Zool. and Entomol., Iowa State Univ., Ames, Iowa). 1973. MORPHOLOGY OF NATURALLY-OCCURRING TRIPLOID FISH RELATED TO Poecilia formosa. Copeia No. 2, 350-352.

The present study provides morphological comparisons between inland sympatric populations of P. mexicana, P. formosa and triploids.

16588. Schulz, Peter D., and Dwight D. Simons. 1973. FISH SPECIES DIVERSITY IN A PREHISTORIC CENTRAL CALIFORNIA INDIAN MIDDEN. Calif. Fish and Game, 59(2): 107-113.

The relative prehistoric abundance of native fish species was investigated by analyzing remains from an aboriginal fishing site in southern Sacramento County, California. The remains of at least 804 fish were examined. Archoplites interruptus was the most abundant species (51.0%), followed by Lavinia exilicauda (20.0%) and Gila crassicauda (12.4%). Nine other species were recorded. The fauna is characteristic of a lacustrine environment, and marked differences from the present day fauna are noted. (Authors)

16589. Roos, J. F., P. Gilhousen, S. R. Killick, and E. R. Zyblut (International Pacific Salmon Fish. Comm., New Westminster, Brit. Columbia, Canada). 1973. PARASITISM ON JUVENILE PACIFIC SALMON (Oncorhynchus) AND PACIFIC HERRING (Clupea harengus pallasi) IN THE STRAIT OF GEORGIA BY THE RIVER LAMPREY (Lampetra ayresi). J. Fish. Res. Bd. Canada, 30(4): 565-568.

River lamprey (Lampetra ayresi) were found to parasitize the young of five species of Pacific salmon (Oncorhynchus) and Pacific herring (Clupea harengus pallasi) in the Strait of Georgia, B. C. The dorsal attachment of the river lamprey is in sharp contrast to the usually ventral attachment of other species of lampreys that parasitize salmonids. Up to 1.9% of young salmon showed evidence of lamprey marks, and marked fish were generally restricted to a narrow size-range. Some of the fish exhibited severe wounds. Evidence from healing wounds on fingerlings and scars on adults indicates that some juvenile salmon survive the attacks of the river lamprey. (Authors)

16590. Bogoyavlenskaya, M. P., I. F. Vel'tishcheva, and G. S. Karzinkin (All-Union Res. Inst. for Sea Fish. and Oceanogr. (VNIRO), Moscow, USSR). 1972. CHARACTERISTIC FEATURES OF METABOLISM AND THE INCORPORATION OF C^{14} INTO ORGANIC COMPOUNDS IN STURGEONS REARED FROM LARGE AND SMALL EGGS. J. Ichthyol., 12(1): 130-134.

An analysis is made of characteristic features of metabolism and incorporation of C^{14} in sturgeon larvae from eggs of different sizes and different amounts of nutrients. Consideration is given to the physiological process of the lessening of differences during the development of the young. In addition, differentiation is shown to exist in the metabolism of sturgeon and sevryuga larvae with the same initial quantity of nutrients in the egg.

16591. Wakabayashi, Hisatsugu, and Syuzo Egusa (Dept. Fishery, Faculty Agr., Univ. of Tokyo, Tokyo, Japan). 1972. CHARACTERISTICS OF A Pseudomonas sp. FROM AN EPIZOOTIC OF POND-CULTURED EELS (Anguilla japonica). Bull. Jap. Soc. Sci. Fish., 38(6): 577-587; Fish Health News, 2(2): p. 15.

Outbreaks of a new bacterial disease 'Sekiten-byo' (red spot disease) caused mass mortalities among pond-cultured eel populations in both Shizuoka and Tokushima prefectures during late spring to early summer in 1971. A remarkable petechial hemorrhage in the body surface appeared to be the sole characteristic symptom of the disease. Generally, a great number of bacteria were found in the blood of moribund fish. The causative organism is a Gram-negative, non-acid-fast, nonsporing rod with a single polar flagellum, measuring about 2 x 0.4 u. The bacilli have metachromatic granules. Growth of the bacterium on a nutrient agar medium was rather slow. Colonies after 72 hr incubation at 25°C on nutrient agar were uniformly round, 1 mm or less in diameter, glistening, light grey, entire, convex, translucent and viscid. Mortality of the organism varied with incubation temperature. Because of the production of oxidase, nonsensitiveness to vibriostat 0/129 and inability both to attack glucose and to produce diffusible pigment, the bacterium is placed in the genus Pseudomonas, group III or IV. The bacterium was found to be not identical in its biochemical characteristics and pathogenicity to fish to any formally established species of the genus Pseudomonas, and thus we suggest that it be identified as Pseudomonas anguilliseptica sp. nov. (Authors)

16592. Kruger, Danuta (Instytut Rybactwa Srodladowego w Olsztynie, Zaklad Gospodarki Stawowej w Zabiencu kolo Warszawy). 1973. BACTERIA NUMBERS IN THE CARP PONDS WITH A STOCK OF SEVERAL FISH SPECIES. (Liczebnosc bakterii w stawach karpiowych z wielogatunkowa obsada ryb). Roczniki Nauk Rolniczych, 95(1): 55-72. In Polish with English synopsis.

Investigations into the basic groups of microorganisms in ponds. It was examined the heterotrophic, proteolytic, ammonifying and desulphation bacteria. In the experimental ponds was bred the hatch and fry of common, silver carp, grass carp, big-head carp and Coregonus peled Gmelin. In the investigation was considered as well the effect of feeding fish and the fertilization of ponds upon the numbers of bacteria. (Auth.)

16593. Amin, Omar M., Joseph S. Balsano, and Kathy A. Pfalzgraf (Div. of Sci., Univ. of Wis., Parkside, Kenosha, Wisconsin). 1973. Lernaea cyprinacea Linn. (COPEPODA: CRUSTACEA) FROM ROOT RIVER, WISCONSIN, FISHES. Amer. Midl. Nat., 89(2): 484-487.

Over 1000 fishes of 19 species and eight families were collected from 10 sites on the Root River (Racine and Milwaukee counties) during the autumn of 1971. Ten species were infested with the copepod Lernaea cyprinacea Linn. All (Catostomus commersoni, Lepomis cyanellus, L. macrochirus, Micropterus salmoides, Cyprinus carpio, Notemigonus crysoleucas, Semotilus atromaculatus, S. margarita, Etheostoma nigrum and Umbra limi) are new state records. The last four species are new host records. Sites and frequency of infestation are discussed in relation to host body size and stream conditions. (Authors)

16594. Ryman, Nils (Inst. of Genetic, Univ. of Stockholm, Sweden). 1972. MORTALITY FREQUENCIES IN HATCHERY-REARED SALMON (Salmo salar L.). Hereditas, 71: 237-242; Swedish Salmon Research Inst. - Report LFI Medd. 4/1973.

The variation of mortalities in salmon in different families and environments has been analysed. The material consisted of a set of hatchery-reared full and half-sib families of varying geographic origin. The mortality measured occurred during a period when a specific type of gill disease sometimes results in extremely high mortalities. Part of the variation of mortalities seems to be explained by genetic variation. (Auth.)

16595. Bowser, Paul R. (Dept. of Zool. and Entomol., Iowa State Univ., Ames, Iowa). 1973. SEASONAL PREVALENCE OF Chondrococcus columnaris INFECTION IN BLACK BULLHEADS FROM CLEAR LAKE, IOWA. J. Wildlife Diseases, 9(2): 115-119.

The prevalence of asymptomatic columnaris infection in black bullheads (Ictalurus melas) from Clear Lake, Iowa, during 1971 was the highest during the spring when the lake was warming, very low as summer approached and nil from July 28 through the autumn. The mean condition factor of adult black bullheads decreased through the month of June and fluctuated at a lower level through the remainder of the summer and autumn. Mean hematocrit of adult black bullheads followed the same trend as that of condition factor. A positive correlation was evident between weekly mean condition factor and hematocrit ($r = 0.90$; $P = 0.01$). (Auth.)

16596. Wobeser, G. (Dept. of Vet. Pathol., Western Coll. of Vet. Med., Univ. of Saskatchewan, Saskatoon, Saskatchewan). 1973. AN OUTBREAK OF REDMOUTH DISEASE IN RAINBOW TROUT (Salmo gairdneri) IN SASKATCHEWAN. J. Fish. Res. Bd. Canada, 30(4): 571-575.

During 1972 an outbreak of disease due to the "RM bacterium" occurred in caged rainbow trout (Salmo gairdneri) in a southern Saskatchewan lake. The mortality rate was approximately 1% of the population per week. Histopathologic lesions involved primarily the hematopoietic and reticuloendothelial systems. It is postulated that the disease was introduced with shipments of trout imported from Idaho shortly before the outbreak. (Auth.)

16597. Pelzman, Ronald J. 1973. CALIFORNIA INLAND ANGLING SURVEY FOR 1970. Calif. Fish and Game, 59(2): 100-106.

This is the tenth report on California inland angling trends as determined from angler response to postal card questionnaires. Questionnaires were sent to 0.5% of the resident license purchasers in 1970. Thirty-nine percent of these were returned, amounting to a 0.2% systematic sample. Catch and effort by successful anglers were determined for trout, striped bass, sturgeon, black bass, catfish, and panfish anglers increased; numbers of successful sturgeon and catfish anglers declined. The striped bass catch increased 36%. Catches of other fishes declined.

16598. Nikolayev, A. S., and A. Yu. Neproshin (Kamchatka Dept., Pacific Res. Inst. for Sea Fish. and Oceanogr. (KOTINRO) and Sukhumi Branch of the Acoustics Inst., USSR, Acad. of Sciences (SFAI). 1972. ACOUSTIC ACTIVITY OF THE SOCKEYE [Oncorhynchus nerka (Walb.)] IN FRESH WATER. J. Ichthyol., 12(1): 134-143.

It has been established as a result of studies of the acoustic activity of the adult sockeye [Oncorhynchus nerka (Walb.)] made in the first half of August 1969 in Lake Kuril'skoye (Southern Kamchatka) that the sockeye emits a number of sounds in the period preceding spawning which are heard as various kinds of clicking, knocking and grinding, differing in their physical characteristics.

16599. Plumb, John A. (Dept. of Fish. and Allied Aquacultures, Agric. Exp. Sta., Auburn Univ., Auburn, Alabama 36830). 1973. EFFECTS OF TEMPERATURE ON MORTALITY OF FINGERLING CHANNEL CATFISH (Ictalurus punctatus) EXPERIMENTALLY INFECTED WITH CHANNEL CATFISH VIRUS. J. Fish. Res. Bd. Canada, 30(4): 568-570.

When water temperature was reduced from 28 to 19 C for channel catfish (Ictalurus punctatus) fingerlings 24 hr after injection with channel catfish virus (CCV), 24% mortality occurred. In comparison, fish held at a constant temperature of 28 C had a mortality of 94% and those held in 19 C water had 14% mortality. Reducing the temperature to 19 C when the first deaths occurred at 28 C (64-72 hr after injection) resulted in 78% mortality. Insignificant mortality occurred in fish injected with Hanks' balanced salt solution. Results of temperature change are discussed as to their potential value in reducing the effects of CCV disease under cultural conditions. (Auth.)

16600. Snieszko, S. F. (Eastern Fish Disease Lab., Kearneysville, West Virginia). 1972. NUTRITIONAL FISH DISEASES. Chap. 9 in Fish Nutrition, ed. by John E. Halver, Academic Press, New York; Fish Health News, 2(2): p. 15.

Dr. Snieszko states in his introduction that little is known of purely nutritional diseases of fishes. His text clearly illustrates the truth of this statement. He points out that most information available concerns salmonids and carp. Literature is thoroughly covered and information presented well. It is a good starting point for those interested in malnutrition of fishes. -- R. L. Herman

16601. Ellefson, Paul V., and Gale C. Jamsen. 1971. ECONOMIC APPRAISAL OF MICHIGAN'S SALMON AND STEELHEAD SPORT FISHERY, APRIL 25 - AUGUST 31, 1970. Mich. Dept. Nat. Res., Research and Development Report No. 243, 21 p.

Fishermen in Michigan were estimated to have spent 703,200 days fishing exclusively for salmon and steelhead from April 25 - August 31, 1970. The net economic value of this fishing is estimated to be $2.986 million. Salmon and steelhead fishing on Lake Michigan and its tributaries accounted for 82 percent ($2.45 million) of the total value. (Authors)

16602. Whitmore, Donald H., and Erwin Goldberg (Dept. Biol. Sci., Northwest. Univ., Evanston, Illinois). 1972. TROUT INTESTINAL ALKALINE PHOSPHATASE. II. EFFECT OF TEMPERATURE ON ENZYMIC ACTIVITY IN VITRO AND IN VIVO. Chemical Abstracts, 77(25): 161421t; Marine Fisheries Abstracts, 26(6): p. 2, 1973.

16603. Galat, David L. (N. Y. Coop. Fish. Unit, N. Y. State Coll. of Agric. and Life Sci., Cornell Univ., Ithaca, New York 14851). 1973. NORMAL EMBRYONIC DEVELOPMENT OF THE MUSKELLUNGE (Esox masquinongy). Trans. Amer. Fish. Soc., 102(2): 384-391.

This paper documents the gross normal embryonic development of the muskellunge, Esox masquinongy, from fertilization until hatching with preserved specimens. Eggs were incubated at 13 C and samples taken every hour during the first 20 hr of incubation and every 6 hr thereafter until hatching on the 13th day. Line drawings illustrate development. (Auth.)

16604. Cheng, Joseph Y. (Fish. Res. Bd. Canada, Vancouver Lab., Vancouver, British Columbia, Canada). 1973. A SIMPLE MICROSCALE VACUUM COLLECTOR FOR THE ELUTION OF CLOSELY SITUATED SPOTS FROM THIN-LAYER CHROMATOGRAMS. J. Fish. Res. Bd. Canada, 30(3): 460-461.

A "homemade" device, utilizing disposable Pasteur pipettes and a side-armed test tube, is described for convenient quantitative removal and elution of closely separated spots from thin-layer chromatograms. Its simplicity of manipulation and "disposability" after use offer an excellent economic and timesaving elution technique for routine handling of numerous samples. (Auth.)

16605. Chew, Leslie E., and Jon G. Stanley (Southern Fish Control Lab., Warm Springs, Georgia 31830). 1973. THE EFFECTS OF METHYLTESTOSTERONE ON SEX REVERSAL IN BLUEGILL. Prog. Fish-Cult., 35(1): 44-47.

Methyltestosterone administered in the diet to bluegill (Lepomis machrochirus) during the first 60 days of life was ineffective in producing complete sex reversal. However, several hermaphroditic individuals were produced in those groups receiving higher doses of hormone, and morphological abnormalities were observed. Sperm from hormonally-induced hermaphrodites were active and might be used in fertilizing eggs from normal females to produce monosex offspring which are females. (Authors)

16606. Wiggs, Alfred J. (Dept. of Zool., Univ. of Alberta, Edmonton, Alberta, Canada). 1973. PARTIAL CHARACTERIZATION OF THE THYROID PROTEINASE OF THE BURBOT, Lota lota L. Comp. Biochem. Physiol., 45(3A): 869-882.

Extracts of burbot thyroids showed peak levels of proteolytic activity at pH 2.5, 3.25 and 4.0. Optimal activity at pH 2.5 had a K_m of 0.154 percent as determined on hemoglobin substrate. After 1 hr at 30°C 20 percent inactivation occurred at pH 7 and 92 percent inactivation at pH 2. Proteinase activity was increased (150-250 percent) in the presence of 0.2 M cysteine and inhibited in the presence of 0.02 M EDTA (95 percent), ferrous ammonium sulphate (70 percent), iodoacetate (50-65 percent), gluthathione (20-40 percent) and methyl-mercapto-imidazole (10-20 percent). Purified mammalian thyroid stimulating hormone (TSH) (2.5 I.U./fish) increased proteinase activity when injected into fish held at 14°C. Proteinase of fish held at 4°C showed no response to TSH but did respond to crude pituitary extracts. The enzyme was inhibited when treated with TSH in vitro. (Auth.)

16607. Uthe, J. F., F. M. Atton, and L. M. Royer (Fish. Res. Bd. of Canada, Freshwater Inst., Winnipeg, Manitoba, Canada). 1973. UPTAKE OF MERCURY BY CAGED RAINBOW TROUT (Salmo gairdneri) IN THE SOUTH SASKATCHEWAN RIVER. J. Fish. Res. Bd. Canada, 30(5): 643-650.

Rainbow trout (Salmo gairdneri) were held in cages in the South Saskatchewan River to assess mercury uptake following curtailment of mercury discharges to the river. There was a rapid uptake of mercury by the fish during the first warm summer period (1970) with much less uptake during the rest of the year. A second summer experiment (1971) produced no significantly different results suggesting that a long-term contamination exists within this river system. Analyses showed that the bulk of mercury present in the fish carcasses was present as methylmercury. (Authors)

16608. Foda, A. (Resource Development Branch, Fish. Serv., Dept. of Environ. of Canada, Fredericton, New Brunswick, Canada). 1973. CHANGES IN HEMATOCRIT AND HEMOGLOBIN IN ATLANTIC SALMON (Salmo salar) AS A RESULT OF FURUNCULOSIS DISEASE. J. Fish. Res. Bd. Canada, 30(3): 467-468.

Decreases in the hematocrit and hemoglobin levels in hatchery-reared juvenile Atlantic salmon (Salmo salar) were associated with a severe infection of Aeromonas salmonicida, the causative agent of furunculosis disease. The lowering of blood hematocrit and hemoglobin levels were attributable to hemorrhages resulting from the infection. (Auth.)

16609. Il'yenko, A. I. (A. N. Severtsov Inst. of Evolutionary Morphol. and Animal Ecology, USSR Acad. of Sciences, Moscow, USSR). 1972. SOME FEATURES OF CAESIUM-137 CONCENTRATION IN FISH POPULATIONS OF A BODY OF FRESH WATER. J. Ichthyol., 12(1): 149-153.

Roach and pike were caught in the period 1969-1970 in a body of water in which caesium-137 content in the water was artificially modified nonperiodically. A study was made of seasonal variation of the content of this radioisotope in the water, in the food of the roach and in the muscles of the roach and the pike. Caesium-137 concentration in the food of the roach and in its muscles reflected the fluctuations of the isotope in the water. Caesium-137 concentration in the muscles of the pike did not coincide with the variation of its content in the water.

16610. Moczarski, Marek (Instytut Zootechniki, Samodzielna Pracownia Biologii Ryb i Srodowiska Wodnego, Zator Kierownik Pracowni: doc. dr Pawel Wolny). 1973. TRIALS WITH PRESERVATION OF CARP SEMEN (Proby Przechowywania spermy karpia). Roczniki Nauk Rolniczych, 95(1): pp. 73-82. In Polish with English synopsis.

The best results in the trials with preservation of carp semen (on the average for 15-16 days long) were obtained at the temperature of 0°C. The semen was preserved in the Alsevers fluid added either ethylene glycol or dimethylsulphoxide. A trial of freezing semen up to the temperature of -79°C and -196°C failed. (Auth. synopsis).

16611. Lientz, Joseph C., and Jerry E. Springer (Bur. Sport Fish. & Wildl., Fish Cult. Dev. Center, Bozeman, Montana). 1973. NEUTRALIZATION TESTS OF INFECTIOUS PANCREATIC NECROSIS VIRUS WITH POLYVALENT ANTISERUM. J. Wildlife Diseases, 9(2): 120-124.

Forty-two isolates of infectious pancreatic necrosis virus were cloned by plaquing, and the clones were used in neutralization tests with a 5-strain polyvalent serum. Seventy-six percent of the strains tested were completely neutralized, 19 percent were partially neutralized and 5 percent were not neutralized. Data provide a measure of the antiserum's diagnostic effectiveness and indicate that at least one more antigenic type should be included in preparation of a definitive polyvalent serum. (Authors)

16612. Brungs, William A., Edward N. Leonard, and James M. McKim (U.S. Environ. Protection Agency, Nat. Wat. Qual. Lab., Duluth, Minnesota 55804). 1973. ACUTE AND LONG-TERM ACCUMULATION OF COPPER BY THE BROWN BULLHEAD, Ictalurus nebulosus. J. Fish. Res. Bd. Canada, 30(4): 583-586.

Brown bullheads (Ictalurus nebulosus) were exposed to constant concentrations of copper ranging from 6.5 to 422 μg/liter. Copper concentrations in gill, opercle, liver, and kidney tissues of live fish did not differ from those that died during the acute exposure. Exposure of fish to sublethal concentrations for 20 days before exposure to lethal concentrations resulted in higher tissue levels in the dead fish than in fish not previously exposed. A distinct increase in liver and gill tissue copper concentrations occurred at exposure levels of 27 μg/liter and above. Equilibrium tissue levels of copper in the liver and gill were reached within 30 days. Copper levels in red blood cells and plasma after 20-months exposure did not differ from the controls. Red blood cells analyzed after 6-days and 30-days exposure to copper also showed no increased copper residues. (Authors)

16613. Umminger, Bruce L. (Dept. of Biol. Sci., Univ. of Cincinnati, Cincinnati, Ohio). 1973. DEATH INDUCED BY INJECTION STRESS IN COLD-ACCLIMATED GOLDFISH, Carassius auratus. Comp. Biochem. Physiol., 45(3A): 883-887.

Goldfish responded to injections of either saline or prolactin with a hyperglycemia and a decline in serum sodium and chloride concentrations. These stress induced responses were most pronounced in fish acclimated to 1°C and less apparent in fish acclimated to 20°C. No deaths were observed in uninjected fish at 20 or 1°C or in injected fish at 20°C. At 1°C, however, eight of eighteen injected fish died within 10 days and the survivors were in poor physiological condition. The stressful effects of injection procedures become progressively more pronounced in goldfish as the acclimation temperature is lowered and, at temperatures near freezing, injection stress is so severe as to cause death. (Auth.)

16614. Havey, Keith A. (Fish. Res. and Mgmt. Div., Maine Dept. of Inland Fish. and Game, Augusta, Maine 04330). 1973. EFFECTS OF A SMELT INTRODUCTION ON GROWTH OF LANDLOCKED SALMON AT SCHOODIC LAKE, MAINE. Trans. Amer. Fish. Soc., 102(2): 392-397.

An introduction of rainbow smelts, Osmerus mordax, into Schoodic Lake, Washington County, Maine as a new forage base for landlocked salmon, Salmo salar, resulted in a marked increase in mean salmon size within 3 years after the initial smelt introduction (1965). Samples for length and weight were from Oneida Lake trap net catches in October and November. A sample of 371 age-III+ salmon captured from 1965-67 averaged 374 mm and 468 g. A sample of 171 age-III+ salmon captured from 1968-70 averaged 442 mm and 814 g. A sample of 54 age-IV+ salmon captured from 1965-67 averaged 419 mm and 598 g. A sample of 176 age-IV+ salmon captured from 1968-70 averaged 480 mm and 1054 g. Scales from salmon at large during the buildup of smelts reflected the increased growth of salmon. Condition factor of 55 age-III+ - V+ salmon in 1966 was 0.76. Condition factor of 176 age-III+ - V+ salmon in 1969 was 1.00. Length and weight increments of salmon from age II+ - IV+ between 1964-66 were 66 mm and 181 g respectively. Length and weight increments of salmon from age-II+ - IV+ between 1967-69 were 188 mm and 988 g respectively. A drastic decline in smelts in winter or spring 1971 seriously curtailed salmon growth. (Auth.)

16615. Symons, P. E. K. (Fish. Res. Bd. of Canada, Biol. Sta., St. Andrews, New Brunswick, Canada). 1973. BEHAVIOR OF YOUNG ATLANTIC SALMON (Salmo salar) EXPOSED TO OR FORCE-FED FENITROTHION, AN ORGANOPHOSPHATE INSECTICIDE. J. Fish. Res. Bd. Canada, 30(5): 651-655.

Exposure of young Atlantic salmon (Salmo salar) to 1.0 ppm fenitrothion for 15-16 hr caused a 50% decrease in the number holding territories 6 days following treatment. Some severely affected fish also swam stiffly and ceased feeding, but these effects disappeared within 48 hr following return to clean water. Territories were not reclaimed for approximately 2-3 weeks. Exposure of 0.1 ppm fenitrothion for 15-16 hr caused a lesser (20%) reduction in numbers of fish holding territories. When mealworms (tenebrio sp.) injected with 2-5 µliters pure (100%) fenitrothion were force-fed to young salmon, 50% were regurgitated 8-12 hr afterwards. Almost all mealworms containing 10-20 µliter fenitrothion were regurgitated. The proportion of worms regurgitated remained constant during a week of daily force-feedings but, 24 hr after the third or fourth feeding, all fish except controls could be made to flex tetanically by rapping on the aquarium, and they made little attempt to escape a dipnet. (Auth.)

16616. Tesarcik, J. (Inst. for Fishery and Hydrobiol. Res., Czech. Acad. Agr., Vodnany, Research Sta. in Ostrava, Czechoslovakia). 1972. DEHELMINTHIZATION OF CARP FRY INFECTED WITH INTESTINAL WORM Neoechinorhynchus rutili BY USING TETRAFINOL. Acta Vet. Brno, 41: 207-210; Fish Health News, 2(2): p. 15.

The paper summarizes the results of dehelminthization of 2-year carp fry performed by oral application of Tetrafinol through feed to carps in a pond of 1.74 ha, in spring 1968. (Excerpt from Auth. summ.)

16617. Trojnar, John R. (Bur. of Sport Fish. & Wildl., Colo. Coop. Fish. Unit, Colo. State Univ., Fort Collins, Colorado 80521). 1973. MARKING RAINBOW TROUT FRY WITH TETRACYCLINE. Prog. Fish-Cult., 35(1): 52-54.

Rainbow trout (Salmo gairdneri) fry (0.18 g) were fed tetracycline at concentrations of 100, 400, and 700 mg/kg body weight/day for 4 to 8 consecutive days. A concentration of 100 mg/kg body weight/day fed for 4 consecutive days appears to be above the minimum dosage required for fry this size. A beef liver diet, at all concentrations, had a greater marking efficiency than a dry diet. There was no loss of mark for fish marked as fry and held under indoor hatchery conditions for 1 year. If fish cannot be examined immediately, they should be frozen. Under field conditions freezing is not always possible. However, there is no loss of mark when fish are stored cold for 4 days and bones are stored dry for 12 days. Fish kept in 10% formalin and 40% isopropyl alcohol solutions lose their mark in 4 days. (Auth.)

16618. Ellefson, Paul V., and Gale C. Jamsen. 1971. ECONOMIC APPRAISAL OF MICHIGAN'S SALMON AND STEELHEAD SPORT FISHERY, SEPTEMBER 1 - DECEMBER 31, 1970. Mich. Dept. Nat. Res., Research and Development Report 244., 12 p.

Fishermen in Michigan were estimated to have spent 871,800 days fishing for salmon and steelhead during the last four months of 1970. The net economic value of this fishing activity is estimated to be $4.239 million. (Authors)

16619. Ahmed, N. U., and N. D. Georganas (Dept. of Elec. Engineering, Univ. of Ottawa, Ottawa, Ontario, Canada K1N 6N5). 1973. OPTIMAL CONTROL THEORY APPLIED TO A DYNAMIC AQUATIC ECOSYSTEM. J. Fish. Res. Bd. Canada, 30(4): 576-579.

In this report we present a dynamic model for an aquatic ecosystem consisting of a single species living in a polluted environment. Considering the dynamics of growth of the species and increase in pollution, we apply optimal control theory to obtain species removal and pollution reduction rates at minimum cost. (Authors)

16620. Dominy, C. L. (Resource Development Branch, Fish. Serv., Dept. of the Environ., Halifax, Nova Scotia, Canada). 1973. EFFECT OF ENTRANCE-POOL WEIR ELEVATION AND FISH DENSITY ON PASSAGE OF ALEWIVES (Alosa pseudoharengus) IN A POOL AND WEIR FISHWAY. Trans. Amer. Fish. Soc., 102(2): 398-404.

A comparison of the rates of passage of alewives (Alosa pseudoharengus) into a pool and weir fishway throughout the peak of the alewife run (May 22 - June 6) in a Nova Scotia river revealed that one entrance weir, built at an elevation 0.21 m (8.0 in) lower than the existing conventional weir, passed alewives at a significantly greater mean rate (56.25/min) than the conventional weir (23.25/min). The mean rate of passage of alewives from pool to pool within the fishway (37.59/min) was not significantly greater or less than the mean rate for either of the entrance weirs. Density tests at two intermediate fishway pools revealed that the relationship between alewife density and exit rate may be described by a curve that rises to a peak exit rate of 80/min at a density of 75/m^3 and then levels off to 70/min at higher densities. It is concluded that crowding and delay is not likely to occur within the fishway at the peak of the alewife run. Values for substitution in the formula of Clay (1961) for calculating fishway capacity determined for the alewife show that this species does not require any more time per fishway pool than Pacific salmon and that the demands of alewives on water volume are about 6 times less than for Pacific salmon. These determinations permit more general application by fisheries resource biologists and engineers of the data presented on crowding, delay and capacity for alewives in a pool and weir fishway. (Auth.)

16621. Smith, John W. (Marine Lab., Aberdeen, United Kingdom). 1972. THE BLOOD FLUKES OF COLD-BLOODED VERTEBRATES AND SOME COMPARISON WITH THE SCHISTOSOMES. Helminthol. Abs., Series A, 41, Part 2, pp. 161-204; Fish Health News, 2(2): p. 15.

16622. Lech, John J. (Dept. of Pharmacol., The Medical Coll. of Wisconsin, Milwaukee, Wisconsin 53233). 1973. PREPARATION AND PROPERTIES OF 3-TRIFLUOROMETHYL-4-AMINOPHENOL. J. Fish. Res. Bd. Canada, 30(3): 461-463.

This note describes a method for the preparation of 3-trifluoromethyl-4-aminophenol (RTFM), a metabolite of 3-trifluoromethyl-4-nitrophenol (TFM), and some of its physical-chemical properties, including infrared spectrum, pKa, and gas chromatography. (Auth.)

16623. Olson, Robert E., and Ivan Pratt (Dept. of Zool., Oregon State Univ., Marine Sci. Center, Newport, Oregon 97365). 1973. PARASITES AS INDICATORS OF ENGLISH SOLE (Parophrys vetulus) NURSERY GROUNDS. Trans. Amer. Fish. Soc., 102(2): 405-411.

Juvenile English sole (Parophrys vetulus) utilize Yaquina Bay, Oregon as a nursery during at least a portion of their first year of life, but the possibility of the existence of additional nursery grounds offshore has not previously been examined. During 1971, young-of-the-year first appeared in Yaquina Bay in February, were abundant from April to September, and most emigrated to offshore areas in October. Examination of English sole, collected both in the estuary and offshore, revealed certain parasites that appeared to be acquired by the fish only while in the estuary. The acanthocephalan Echinorhynchus lageniformis proved useful in determining the extent of estuarine utilization. The incidence of infection in bay fish before emigration (29.9%) was similar to the incidence in 0-group English sole collected offshore after emigration (28.5%). This result suggests that there was little or no influx of young from other than estuarine nursery grounds to the offshore study area and that on the Oregon coast, estuaries are very likely the exclusive nursery grounds for this species. Other parasites were not useful in determining the extent of estuarine utilization, but two, the nematode Philometra americana and a microsporidan Glugea sp., were considered to be indicators of residence in the upper estuary. The trematode Zoogonus dextrocirrus and metacercaria of the trematode Otodistomum veliporum were found almost exclusively in fish collected offshore, indicating little or no back-and-forth movement between estuary and open ocean. (Authors)

16624. Ellefson, Paul V., and Gale C. Jamsen. 1971. MICHIGAN'S SALMON-STEELHEAD TROUT FISHERY: AN ECONOMIC EVALUATION. Mich. Academacian 4(2): 237-244.

Michigan's salmon and steelhead sport fishery produced nearly two million days of fishing for an estimated 200,000 anglers in 1970. The catch of salmon (coho and chinook) and steelhead was estimated to be about 1.2 million. The net economic value of the salmon and steelhead resource is estimated to be $8.34 million. (Authors)

16625. Ayles, G. B., and A. H. Berst (Dept. of Zool., Univ. of Toronto, Toronto, Ontario, Canada). 1973. PARENTAL AGE AND SURVIVAL OF PROGENY IN SPLAKE HYBRIDS (Salvelinus fontinalis X S. namaycush). J. Fish. Res. Bd. Canada, 30(4): 579-582.

While examining the survival rates of eggs in a splake brood stock, it was found that the survival of progeny from egg to the time of yolksac absorption increased as the age of the parents increased. Examination of spawning success of individual fish in another brood stock indicated that the increased survival rate was related to the female parent. There was no effect of the female parent on survival from eggs to eyed eggs, but there was a significant effect of survival from eyed eggs to hatch and from hatch to the time of yolksac absorption. (Authors)

16626. Takahashi, Yukinori, and Riichi Kusuda. 1971. STUDIES ON THE SCALE PROTRUSION DISEASE OF CARP FISH. II. IMMUNE RESPONSE OF CARP TO Aeromonas liquefaciens. Fish Pathology, 6(1): 24-29; Fish Health News, 2(2): p. 13. In Japanese.

16627. Patten, Benjamin G. (NMFS, Northwest Fish. Center, 2725 Montlake Blvd East, Seattle, Washington 98112. 1973. BIOLOGICAL INFORMATION ON COPPER ROCKFISH IN PUGET SOUND, WASHINGTON. Trans. Amer. Fish. Soc., 102(2): 412-416.

Copper rockfish (Sebastes caurinus), a species that is becoming increasingly important as a sport fish, were studied in two shallow areas in Puget Sound, from 1963 to 1968, to obtain information on seasonal availability, growth, maturation, feeding habits, and ecology. Specimens examined ranged from 6.8 to 47.0 cm in fork length and from 0 to 8 years old. Availability was greatest in September and October and least in June and July. Length-weight regression was the same for both sexes but differed by time of year ($W = 0.000016231^{3.040252}$ for September to November and $W = 0.000024945^{2.953381}$ for December to March). Both sexes were usually mature at age IV. Crustacea and fish were the principal foods. The rockfish hid in rock interstices in the winter but not in the summer. (Auth.)

16628. Beamish, R. J. (Dept. of the Environ., Fish. Res. Bd. of Canada, Freshwater Inst., Winnipeg, Manitoba, Canada). 1973. DESIGN OF A TRAPNET WITH INTERCHANGEABLE PARTS FOR THE CAPTURE OF LARGE AND SMALL FISHES FROM VARYING DEPTHS. J. Fish. Res. Bd. Canada, 30(4): 587-590.

The use of new materials and a modification of the basic trapnet design produced nets that fished successfully for large and small fishes in areas where conventional collecting techniques were difficult to apply. Parts of the trap can be interchanged to fish at depths of 1-5 m. (Auth.)

16629. Koch, D. L., and G. P. Contreras (Dept. of Biol., Univ. of Nevada, Reno, Nevada 89507). 1973. HATCHING TECHNIQUE FOR THE CUI-UI LAKESUCKER. Prog. Fish-Cult., 35(1): 61-63.

The Cui-ui Lakesucker (Chasmistes cujus) is currently listed as an endangered species according to section 1 (c) of the Endangered Species Preservation Act of October 1966. Endemic to Pyramid Lake, Washoe County, Nevada; the Cui-ui population has been on a sharp decline due to a deterioration of its natural spawning grounds. We attempted to develop artificial propagation techniques as a means of increasing the population and saving the species from extinction. Eggs collected and fertilized were first water hardened and then given a silt bath to prevent adhesiveness. Processed eggs were put in hatching jars and baskets for hatching. Hatching occurred while eye development followed 31 hours later with a mean water temperature of 50 F. Fungus of the genus Saprolegnia appeared to attack unfertilized and damaged eggs, so Malachite green was used to protect developing eggs. Embryonic and larval development are presently being sectioned for a detailed analysis through maturity. (Authors)

16630. Naiman, Robert J., Shelby D. Gerking, and Thomas D. Ratcliff (Dept. of Zool., Arizona State Univ., Tempe, Arizona). 1973. THERMAL ENVIRONMENT OF A DEATH VALLEY PUPFISH. Copeia No. 2, pp. 366-369.

The most interesting adaptations of the pupfish are high salinity tolerance and an ability to withstand wide temperature fluctuations, but the pupfish is not as was once suspected, living in a severe environment with respect to high temperatures.

16631. Rawson, Mac V., and Wilmer A. Rogers (Ga. Coop. Fish. Unit, School of Forest Resources, Univ. of Ga., Athens, Georgia). 1973. SEASONAL ABUNDANCE OF Gyrodactylus macrochiri Hoffman and Putz, 1964 ON BLUEGILL AND LARGEMOUTH BASS. J. Wildlife Diseases, 9(2): 174-177.

Specimens of Gyrodactylus macrochiri were collected from bluegill, Lepomis macrochirus and largemouth bass, Micropterus salmoides, in Walter F. George Reservoir at 2 week intervals from December 1967 to January 1969. The G. macrochiri populations were at high levels during the hosts' spawning in the spring, at temperatures similar to the spawning period in the fall period and during winter. During mid-summer at temperatures above 28 C the populations on both host species were at their lowest levels. (Authors)

16632. Rommel, S. A., Jr., and J. D. McCleave (Univ. of Maine, Orono, Maine 04473). 1973. SENSITIVITY OF AMERICAN EELS (Anguilla rostrata) AND ATLANTIC SALMON (Salmo salar) TO WEAK ELECTRIC AND MAGNETIC FIELDS. J. Fish. Res. Bd. Canada, 30(5): 657-663.

Two long distance migrating fishes, the American eel (Anguilla rostrata) and the Atlantic salmon (Salmo salar), consistently showed conditioned cardiac responses to weak electric fields applied perpendicular but not parallel to their bodies. In fields with a power density of 0.11×10^{-3} pW/cm^3, 63% of the eels tested were successfully conditioned, as were 56% of the salmon tested at 0.9×10^{-4} pW/cm^3. At greater field intensities greater percentages of salmon and eels were successfully conditioned. However, at two lower intensities fewer salmon and no eels responded. These fields are of the magnitude that occur naturally in ocean currents. As geoelectric fields are perpendicular to the water motion that generates them, this sensitivity might allow a migrating fish to align itself upstream or downstream in an ocean current in the absence of fixed references. Results of magnetic conditioning experiments in eels were equivocal. Attempts to condition salmon to weak magnetic fields were unsuccessful. (Authors)

16633. Nagiec, M., and P. Ostrowski (WSR w Olsztynie, Wydzial Ochrony Wod i Rybactwa Srodladowego, Instytut Rybactwa Srodladowego). 1973. SELECTIVITY OF GILL-NETS FOR FISHING PIKEPERCH. (Selektywnosc Wontonow Sandaczowych). Roczniki Nauk Rolniczych, 95(1): 83-99. In Polish with English synopsis.

On the basis of fishing tests a relation was stated between the size of gill-nets and the size of the pikeperch caught. It was taken into consideration as well the manner the fishes are entangled in the net. It was attempted to estimate the selectivity of each size of gill-net using the method by Holt. (Authors' synopsis)

16634. Kroger, Richard L., and James F. Guthrie (NMFS, Atlantic Estuarine Fish. Center, Beaufort, North Carolina 28516). 1973. MIGRATIONS OF TAGGED JUVENILE ATLANTIC MENHADEN. Trans. Amer. Fish. Soc., 102(2): 417-422.

From 1967 to 1971 over 80,000 juvenile Atlantic menhaden, Brevoortia tyrannus, were tagged from Florida to Massachusetts. Returns of the internal ferromagnetic body tags from the commercial menhaden fisheries indicate the juveniles migrate as far south as Florida in the fall and winter and then redistribute northward along the coast by size as age-I fish during the following spring and summer. Larger 1-year-old fish migrate north earlier and in greater numbers than small ones which remain in more southern waters where some are not available to the fisheries for part of the year. Some northward movement of age-I fish from the South Atlantic fishing area to Chesapeake Bay, evidently occurs through midsummer. (Authors)

16635. Jamsen, G. C. 1971. MICHIGAN'S MAIL CREEL CENSUS METHODOLOGY. Mich. Dept. Nat. Res., Research and Development Report 252, 5 p.

This is a how-to-do-it paper explaining the steps and procedures used in assessing the kinds and amount of fishing recreation being provided on Michigan's lakes and streams. Topics covered are sample selection, mail procedures, questionnaire development, coding, data editing, presentation of results, and survey costs. (Auth.)

16636. Kaya, Calvin M. (Lab. of Limnol., Univ. of Wisconsin, Madison, Wisconsin). 1973. EFFECTS OF TEMPERATURE AND PHOTOPERIOD ON SEASONAL REGRESSION OF GONADS OF GREEN SUNFISH, Lepomis cyanellus. Copeia No. 2, pp. 369-373.

In green sunfish, rates of gonadal regression were greatly affected by temperature but very little by photoperiod.

16637. Hester, F. Eugene (Div. of Fishery Research, Bur. of Sport Fish. & Wildl., Washington, D. C. 20240). 1973. FISH HEALTH: A NATIONWIDE SURVEY OF PROBLEMS AND NEEDS. Prog. Fish-Cult., 35(1): 11-18.

16638. Saether, Ole A. (Fish. Res. Bd. of Canada, Freshwater Inst., Winnipeg 19, Manitoba, Canada). 1973. TAXONOMY AND ECOLOGY OF THREE NEW SPECIES OF Monodiamesa Kieffer, WITH KEYS TO NEARCTIC AND PALAEARCTIC SPECIES OF THE GENUS (DIPTERA: CHIRONOMIDAE). J. Fish. Res. Bd. Canada, 30(5): 665-679.

Three Nearctic species of Monodiamesa are described: Monodiamesa depectinata sp. n. from male imagines, pupa, and fourth- and third-instar larvae; Monodiamesa tuberculata sp. n from imagines, pupae, and fourth- and third-instar larvae; and Monodiamesa prolilobata sp. n. from male imagines. A larva possibly belonging to M. prolilobata is described. These are the first records and descriptions of imagines of Nearctic species of this genus. Keys are given for male imagines, pupae, and larvae of the Nearctic and Palaearctic species of the genus. Monodiamesa depectinata occurs in the Laurentian Great Lakes area and in Lake Winnipeg, Man. It was taken from sandy substrates in the lower littoral and the sublittoral zones of oligotrophic to mesotrophic lakes. Monodiamesa tuberculata occurs from the mainland of British Columbia through the prairie provinces and the Northwest Territories to the Laurentian Great Lakes. It was taken from the sublittoral and profundal zones of oligotrophic lakes and in some lakes is probably a glacial relict. Monodiamesa prolilobata, from west of the Rocky Mountains, probably covers the combined ecological niches of the two more easterly species. (Auth.)

16639. Frame, David W. (U.S. Dept. of Commerce, Middle Atlantic Coastal Fish. Center, Sandy Hook Lab., Highlands, New Jersey 00732). 1973. BIOLOGY OF YOUNG WINTER FLOUNDER Pseudopleuronectes americanus (Walbaum); METABOLISM UNDER SIMULATED ESTUARINE CONDITIONS. Trans. Amer. Fish. Soc., 102(2): 423-430.

Metabolism based on laboratory studies of young winter flounder acclimated to estuarine-like conditions show that rates of oxygen uptake (ml O_2/hr/g), as a function in increasing temperature, do not differ significantly between salinities of 10 and 20 °/oo. There is, however, a 40-50% decrease in the quantities of oxygen consumed by fish subjected to salinities of 10 and 20 °/oo. Metabolic rates do not differ between fish sizes used (within the I+ group; 100 - 135 mm total length and 140 - 175 mm total length). Slopes in the equation, log metabolism = log a + b log weight, for temperatures of 24 C, 20 C, and 16 C (30 °/oo salinity) exceed unity. (Auth.)

16640. Engel, James M. (Bur. Sport Fish. & Wildl., Jordan River National Fish Hatchery, Elmira, Michigan 49730). 1973. CHEMICAL DISBURSEMENT SYSTEM. Prog. Fish-Cult., 35(1): 59.

A system for disbursing chemicals to egg incubator stacks is described. By using air pressure, treatments may be administered accurately to a varying number of stacks with minimal adjustment. (Auth.)

16641. Wirén, Bibie. 1971. WART DISEASE IN ATLANTIC SALMON (Salmo salar L.) HISTOLOGICAL STUDIES OF EPIDERMAL PAPILLOMA IN REARED SALMON. [Vårtsjuka hos lax (Salmo salar L.) histologiska studier över epidermala papillom hos odlad lax]. Swedish Salmon Res. Inst. - Report LFI MEDD. 7, 9 p.

Epidermal cells of normal skin and of the epidermal papilloma of the salmon, Salmo salar L. were compared by light and electron microscopy. The normal cells are characterized by complex microvillous interdigitations between adjacent cells, and numerous desmosomes. Mucous cells are frequent. In contrast, in the epidermal papilloma mucous cells are absent, the cell membranes do not interdigitate, and they lack desmosomes. The papilloma cells are in addition characterized by anaplasia and a high mitotic rate with atypical mitoses frequently appearing. Particles of possible viral nature are found. (Auth.)

16642. Ziebell, Charles D. (Bur. Sport Fish. & Wildl., Ariz. Coop. Fish. Unit, Univ. of Ariz., Tucson, Arizona 85721). 1973. ULTRASONIC TRANSMITTERS FOR TRACKING CHANNEL CATFISH. Prog. Fish-Cult., 35(1): 28-32.

16643. Wobeser, G., and F. M. Atton (Dept. of Vet. Pathol., Western Coll. of Vet. Med., Univ. of Sask., Saskatoon, Saskatchewan, Canada). 1973. AN OUTBREAK OF COLUMNARIS DISEASE IN WHITE SUCKERS (Catostomus commersoni) IN SASKATCHEWAN. J. Fish. Res. Bd. Canada, 30(5): 681-683.

Columnaris disease, due to Chondrococcus columnaris, was diagnosed during a die-off of white suckers (Catostomus commersoni) in a lake in Saskatchewan. The pathology of the disease in white suckers is described. This is the first known report of columnaris disease from the prairie region of Canada. (Authors)

16644. Havey, Keith A. (Fish. Res. and Mgmt. Div., Maine Dept. of Inland Fish. and Game, Augusta, Maine 04330). 1973. PRODUCTION OF JUVENILE ALEWIVES, Alosa pseudoharengus, AT LOVE LAKE, WASHINGTON COUNTY, MAINE. Trans. Amer. Fish. Soc., 102(2): 434-437.

From 1960-71, 4,601 adult anadromous alewives were counted as they entered Love Lake to spawn. At the 0.05 probability level the observed numbers of males and females did not differ from a 1:1 ratio. Males averaged 295 $\pm$ 1.2 mm and females 305 $\pm$ 1.3 mm in total length. The length difference between sexes was significant at the 95% confidence level. Average in-lake mortality of adults was 90.7% (range 66.6% to 100%). Between 1960-71, 1,026,386 juveniles emigrated from Love Lake. Emigrations varied from 220 in 1962 to 439,062 in 1967. Mathematically weighted mean weight of emigrants for the years 1961, 1963-69, and 1971 was 3.5 g. Weight of emigrants (kg/ha) varied from 0.018 to 4.794 per year. Number of emigrants per ha per year varied from 0.81 to 1614.19. Emigrants per female per year ranged from 12 to 3,209. Weight of emigrants per female per year ranged from 0.09 kg to 21.50 kg. There is a significant linear relationship between number of juvenile emigrants and number of adult immigrants 4 years later. There is also a significant linear relationship between log of magnitude of female escapement and log of numbers of juvenile emigrants produced. (Auth.)

16645. Kusuda, Riichi, and Naoki Mizuro. 1969. In Vitro EFFECTS OF TETRACYCLINE ANTIBIOTICS ON CAUSATIVE BACTERIA OF ULCER DISEASE OF MARINE FISH. Fish Pathology, 3(2): 14-17; Fish Health News, 2(2): p. 13. In Japanese.

16646. Zhiteneva, L. D., and N. P. Sokol'skaya (Rostov Lab. of the Intensification of Pond Fish Farming, Caspian Fish. Res. Inst., USSR). 1972. CHANGES IN THE MORPHOLOGICAL COMPOSITION OF THE BLOOD OF FISH LARVAE BITTEN BY WATER BOATMEN (CORIXIDAE). J. Ichthyol., 12(1): 154-159.

Changes in the blood of carp, grass carp and sterlet larvae after they had been bitten by water boatmen (family Corixidae) was studied. The venom of these bugs, which possesses hemolytic properties, causes degradation of erythrocytes leading to their swelling and destruction. Pathological changes also occur in the white blood cells: mature leukocytes swell greatly and a profusion of immature cells (primary lymphoblasts or leukoblasts) appears. Irreversible processes arising in the blood of fish larvae lead to their death. Sterlet larvae, in which changes in the blood are most intensive, are particularly sensitive to the bites of water boatmen.

16647. Jamsen, Gale C. 1973. MICHIGAN'S 1972 SPORT FISHERY. Mich. Dept. Nat. Res., Surveys and Statistics Report 122, 6 p.

Estimates are presented of the catch and effort of sport fishermen in Michigan. Responses from a mail survey of one percent of Michigan's 1.2 million licensed fishermen formed the data base for the estimates. (Auth.)

16648. Crawford, David L., and Duncan K. Law (Dept. of Food Sci. and Technol., Seafoods Lab., Oregon State Univ., Astoria, Oregon 97103). 1973. STORAGE AND NUTRITIONAL CHARACTERISTICS OF MODIFIED OREGON MOIST RATIONS AS AN INTERMEDIATE-MOISTURE PRODUCT. Prog. Fish-Cult., 35(1):33-38.

16649. Martin, F. Douglas, and Clark Hubbs (Dept. of Zool., Indiana Univ., Bloomington, Indiana 47401). 1973. OBSERVATIONS OF THE DEVELOPMENT OF PIRATE PERCH, Aphredoderus sayanus (PISCES: APHREDODERIDAE) WITH COMMENTS ON YOLK CIRCULATION PATTERNS AS A POSSIBLE TAXONOMIC TOOL. Copeia No. 2, pp. 377-379.

Observations recorded here in regard to development of the pirate perch, Aphredoderus sayanus, begin with fertilization and end four days post-hatching.

16650. Gruchy, C. G., R. H. Bowen, and I. M. Gruchy (Ichthyol. Unit., Nat'l Museum of Nat. Sciences, Ottawa, Onatrio K1A OM8, Canada). 1973. FIRST RECORDS OF THE STONEROLLER (Campostoma anomalum) AND THE BLACKSTRIPE TOPMINNOW (Fundulus notatus) FROM CANADA. J. Fish. Res. Bd. Canada, 30(5): 683-684.

Stoneroller (Campostoma anomalum) and blackstripe topminnow (Fundulus notatus) were found, respectively, in the Thames and Sydenham rivers of southwestern Ontario. These are new records for Canada. (Authors)

16651. Michigan Dept. Natural Resources. 1973. MICHIGAN's GREAT LAKES TROUT AND SALMON FISHERY (1969-1972). Mich. Dept. Nat. Res., Fish. Mgmt. Report 5, 110 p.

A compendium of biological and economic evaluations of Michigan's Great Lakes trout and salmon sport fishery resource. Also included are reports on the assessment of sport fishing activity in 1971 and non-recreational use of Great Lakes salmon and trout.

16652. Vladykov, Vadim D. (Dept. of Biol., Univ. of Ottawa, Ottawa, Ontario, Canada). 1973. MACROPHTHALMIA IN THE AMERICAN EEL (Anguilla rostrata). J. Fish. Res. Bd. Canada, 30(5): 689-693.

Three American eels (Anguilla rostrata) with unusually large eyes, obtained from the collections of the Museum of Zoology, University of Michigan (UMMZ 80616), are described. Two are males, 495 and 521 mm in total length, and the third, probably of the same sex, had an estimated length of 752 mm. The horizontal diameter of the eye was equal to the interorbital width in the smallest specimen, while in the two others it was greater. These fish, captured in 1926, came from a sample of elvers liberated into Sherman Lake, Michigan, about 35-40 years earlier. (Auth.)

16653. Okoniewski, Zygmunt, and Grazyna Okoniewska (Instytut Rybactwa Srodladowego w Olsztynie, Zaklad Gospodarki Stawowej w Zabiencu). 1973. TRIAL TO DETERMINE THE SIGNIFICANCE OF FROGS AND TADPOLES IN THE NURSERY PONDS (Proba okreslenia znaczenia zab i kijanek w stawach karpiowych typu przesadek I). Roczniki Nauk Rolniczych, 95(1): 111-128. In Polish with English synopsis).

Results of research of frog and tadpole food as well as the biomass quantity of fish and tadpole was shown. It was found that frogs ate up the carp larvae. The tadpoles were found to feed up largely on phytoplankton, and besides they ate larvae as well as Chironomidae pupae and zooplankton. The number of tadpoles was found to be influenced by the date of filling the nursery ponds with water, the intensity of pairing period in amphibia, the disturbance of reproduction, and the fertility of the pond. Limitation to minimum of the numbers of frogs and tadpoles has increased by some one third the catches of carp fry. The biomass of the fishes caught was the higher, the lower was the biomass of tadpoles.

16654. Rommel, S. A., Jr. (Zool. Dept. Univ. of Maine, Orono, Maine). 1973. A SIMPLE METHOD FOR RECORDING FISH HEART AND OPERCULUM BEATS WITHOUT THE USE OF IMPLANTED ELECTRODES. J. Fish. Res. Bd. Canada, 30(5): 693-694.

Recording fish heart and operculum beats directly from the water is possible within a limited range of water resistivity. This method can minimize fish handling in some physiological experiments. (Auth.)

16655. Federova, G. V. (State Res. Inst. for Lake and River Fish., (GosNIORKh), Leningrad, USSR). 1972. THE BIOLOGICAL EFFECT OF RADIOCARBON (C^{14}) ON FISH IN THE EARLY DEVELOPMENT STAGES. J. Ichthyol., 12(1): 173-177.

The occurrence of abnormal pelyad larvae is related to the stage of embryonic development at which the action of C^{14} begins, and also to the $NaHC^{14}O_3$ concentration employed. The hatching dynamics of larvae with developmental abnormalities differs from that of the control larvae. Deformed larvae hatch more rapidly than normal larvae. The types of deformation which arise in pelyad larvae under the influence of C^{14} are very similar to those observed after the effect of a number of radionuclides and of external ionizing radiation. (Auth. conclusions)

16656. Baldwin, Wayne J. (Hawaii Inst. of Marine Biol., Univ. of Hawaii, Honolulu, Hawaii 96822). 1973. RESULTS OF TESTS TO INVESTIGATE THE SUITABILITY OF FISH PUMPS FOR MOVING LIVE BAITFISHES. Prog. Fish-Cult., 35(1): 39-43.

16657. Ssentongo, G. W., and P. A. Larkin (Inst. of Animal Resource Ecology, The Univ. of British Columbia, Vancouver 8, British Columbia, Canada). 1973. SOME SIMPLE METHODS OF ESTIMATING MORTALITY RATES OF EXPLOITED FISH POPULATIONS. J. Fish. Res. Bd. Canada, 30(5): 695-698.

Some simple equations are derived from mortality functions that enable estimation of the total mortality coefficient from the mean age and the age of first capture, or the mean length and the length of first capture, of fish in a catch. (Authors)

16658. Gunstrom, Gary K. (Coll. of Fish., Univ. of Washington, Seattle, Washington 98195). 1973. GROSS PHYSICAL ANOMALIES IN F_1 PROGENY OF IRRADIATED AND UNIRRADIATED COHO SALMON. Trans. Amer. Fish. Soc., 102(2): 438-442.

The F_1 progeny of irradiated and unirradiated coho salmon were the object of a study on the occurrence of gross physical anomalies. Experimental lots consisted of 69,000 F_1 progeny of coho salmon that had been irradiated during the egg-and-yolk-absorption stage with a 0.1 curie cobalt-60 source at a daily dose of 0.44 roentgens, resulting in a total dose of 40 roentgens. Control lots consisted of 95,500 F_1 progeny of unirradiated coho salmon. Anomalies that occurred most commonly in both experimental and control lots were those concerning the operculum, the spinal column, the tail, and the fins. No significant differences were found between experimental and control lots in regard to the occurrence of gross physical anomalies. (Auth.)

16659. Drummond, R. A., W. A. Spoor, and G. F. Olson (U.S. Environ. Protection Agency, Nat'l Water Qual. Lab., Duluth, Minnesota 55804). 1973. SOME SHORT-TERM INDICATORS OF SUBLETHAL EFFECTS OF COPPER ON BROOK TROUT, Salvelinus fontinalis. J. Fish. Res. Bd. Canada, 30(5): 698-701.

Changes in cough frequency, locomotor activity, and feeding behavior of yearling brook trout appeared within 2-24 hr at copper concentrations as low as 6-15 μg/liter. Each of these responses appears to be useful for predicting the concentration range of copper likely to have no long-term effects on the species. (Authors)

16660. Childs, E. A. (Seafoods Lab., Dept. of Food Sci. and Technol., Oregon State Univ., Astoria, Oregon 97103). 1973. ELECTROPHORESIS OF FISH MYOFIBRILLAR PROTEINS WITH SODIUM-DODECYL SULFATE-POLYACRYLAMIDE GEL. J. Fish. Res. Bd. Canada, 30(5): 706-707.

A method for electrophoretic separation of fish myofibrillar proteins is described. After incubation in phosphate buffer containing β-mercaptoethanol, sodium-dodecyl sulfate (SDS), and urea, the proteins are separated by SDS-acrylamide gel electrophoresis. (Auth.)

16661. Carlson, Anthony R. (U.S. Environ. Protection Agency, Nat'l Water Qual. Lab., Duluth, Minnesota 55804). 1973. INDUCED SPAWNING OF LARGEMOUTH BASS [Micropterus salmoides (Lacépède)]. Trans. Amer. Fish. Soc., 102(2): 442-444.

When water temperature and photoperiod were manipulated, largemouth bass were induced to spawn successfully in laboratory tanks during the months of December, January, February, May, June and July. (Auth.)

16662. Giger, Richard D. (Oregon State Game Comm., Res. Div., Corvallis, Oregon 97331). 1973. A MECHANIZED BEACH SEINE. Prog. Fish-Cult., 35(1): 48-51.

16663. Radziej, Joachim (Instytut Rybactwa Srodladowego, Zaklad Techniki Rybolowstwa, Olsztyn-Kortowo Kierownik Zakladu: dr Wiktor Dembinski). 1973. THE EFFECT OF SITE UPON SLOWLY GROWING Coregonus albula (Linnaeus 1758) TRANSFERRED FROM THE LAKE NARIE TO THE LAKE WIERZBICZANY. (Wplyw Srodowiska na wolnorosnaca sielawe [Coregonus albula (Linnaeus 1758)] wsiedlona z jeziora narie do jeziora wierzbiczany). Roczniki Nauk Rolniczych, 95(1): 129-146. In Polish with English synopsis.

Coregonus albula (Linnaeus 1758) occurring in Lake Narie is characterized with a slow growth. After introducing it into Lake Wierzbiczany the rate of increase in the length and weight of its body proved to be considerably higher. Coregonus albula (L.) in Lake Wierzbiczany at the age 2+ attained mean length (l.t.) of 21.7 cm and mean weight of 81.4 g, while the population in the native Lake Narie at the same age attained the length of 18 cm and the height of 42.6 g.

16664. Smith, E. N., B. J. Venables, and O. T. Lind (Dept. of Biol. and The Inst. of Environ. Studies, Baylor Univ., Waco, Texas 76703). 1973. A VERSATILE AND INEXPENSIVE VARIABLE VOLTAGE PULSATOR FOR ELECTROFISHING. Trans. Amer. Fish. Soc., 102(2): 468-469.

16665. Smith, Waldina E., Kaye Funk, and Mary E. Zabik (Dept. of Food Sci. and Human Nutr., Michigan State Univ., East Lansing, Michigan 48823). 1973. EFFECTS OF COOKING ON CONCENTRATIONS OF PCB AND DDT COMPOUNDS IN CHINOOK (Oncorhynchus tshawytscha) AND COHO (O. kisutch) SALMON FROM LAKE MICHIGAN. J. Fish. Res. Bd. Canada, 30(5): 702-706.

Concentrations of polychlorinated biphenyls (PCBs) and DDT compounds in chinook (Oncorhynchus tshawytscha) and coho (O. kisutch) salmon steaks were reduced slightly by cooking. In chinook, poaching and baking caused reductions of PCBs and pesticides of 2-8% while baking in nylon cooking bags reduced residue levels 11-16%. No significant differences in residue levels were found between chinook steaks cooked with and without skin, while steaks from the anterior halves contained less PCB and pesticide on a fat basis than steaks from the posterior halves. Analyses of a limited number of coho steaks indicated that they were lower in PCB and DDT compounds than the chinook steaks but showed no consistent pattern of reduction due to cooking method. (Authors)

16666. Bulkley, Ross V., and Gary L. Swihart (Iowa Coop. Fish. Unit, Iowa State Univ., Ames, Iowa 50010). 1973. EFFECTS OF THE ANABOLIC STEROID STANOZOLOL ON GROWTH OF CHANNEL CATFISH, Ictalurus punctatus, AND GOLDFISH, Carassius auratus. Trans. Amer. Fish. Soc., 102(2): 444-446.

In tests ranging from 3 to 8 weeks, the anabolic steroid Stanozolol added to the diet of channel catfish and goldfish did not significantly improve weight gains. (Authors)

16667. Crutchfield, James A. (Dept. of Economics, Univ. of Washington, Seattle, Washington 98195). 1973. ECONOMIC AND POLITICAL OBJECTIVES IN FISHERY MANAGEMENT. Trans. Amer. Fish. Soc., 102(2): 481-491.

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16668. Newton, Scott H., and Raj V. Kilambi (Dept. of Zool., Univ. of Ark., Fayetteville, Arkansas 72701). 1973. FECUNDITY OF THE WHITE BASS, Morone chrysops (Rafinesque), IN BEAVER RESERVOIR, ARKANSAS. Trans. Amer. Fish. Soc., 102(2): 446-448.

The relationships between fish total length, weight, and age to fecundity were determined for 57 white bass females collected in 1967. These relationships were F = 7.51 L - 2040, F = 1.03 W - 262, and F = 309.12 A -243. (Authors)

16669. Dennison, Bernard A., and Michael J. Marchyshyn (Bur. of Sport Fish. and Wildl., Boston, Massachusetts 02109). 1973. A DEVICE FOR ALLEVIATING SUPERSATURATION OF GASES IN HATCHERY WATER SUPPLIES. Prog. Fish-Cult., 35(1): 55 -58.

16670. Ward, F. J., and Masami Nakanishi (Dept. of Zool., Univ. of Manitoba, Winnipeg 19, Manitoba, Canada). 1973. A COMPARISON OF LIQUID SCINTILLATION AND GEIGER-MÜLLER ESTIMATES OF PRIMARY PRODUCTIVITY IN AN IN SITU EXPERIMENT. J. Fish. Res. Bd. Canada, 30(5): 708-711.

For an in situ experiment conducted in Shiozu Bay, Lake Biwa, Japan, primary productivity estimates from liquid scintillation radioactivity counts of wet algae were generally higher than those from Geiger-Müller radioactivity counts of desiccated algae. Values at 0 m were similar, the G-M estimate at 0.5 m was 10% higher, but from 3 to 13 m the liquid scintillation values ranged from 11 to 33% higher than G-M estimates. The 20-m estimates were low and similar. Differences were caused primarily by ^{14}C losses during desiccation prior to G-M counting. Increasing loss rates between 0.5 and 3.0 m may have been caused by decreasing light intensity. On the basis of surface area, the estimate from liquid scintillation data was 27% greater than that obtained from G-M data. (Authors)

16671. Banerjee, Tapan (Dept. of Marine Sci., Southern Maine Vocational Tech. Inst., Fort Road, South Portland, Maine 04106). 1973. AGE AND RATE OF GROWTH OF THE WHITE SEAPERCH (Phanerodon furcatus) FROM TOMALES BAY, CALIFORNIA. Trans. Amer. Fish. Soc., 102(2): 448-450.

Scales of white seaperch were used to determine the ages of 169 males and 795 females collected from Tomales Bay, California during 1965. The maximum age of female fishes during the course of the study was 7 years (279-280 mm in fork length). No males were encountered that were older than 6 years (250-260 mm in fork length). The growth of both sexes of white seaperch was considerably faster in the young than at a later age. Weight-length relationship shows that the females tend to grow faster than males of the same length.

16672. Lackey, Robert T. (Dept. of Fish. & Wildl. Sciences, Va. Polytechnic Inst. and State Univ., Blacksburg, Virginia 24061). 1973. EFFECTS OF ARTIFICIAL DESTRATIFICATION ON ZOOPLANKTON IN PARVIN LAKE, COLORADO. Trans. Amer. Fish. Soc., 102(2): 450-452.

Parvin Lake, Colorado, a 19 ha montane reservoir, was artificially destratified for 1 year. Abundance of cladocerans (collectively) and Daphnia schødleri was lower during destratification. Abundance of rotifers (collectively) was lower during winter months and higher during summer months of the destratification year. Abundance of copepods (mainly Diaptomus spp.) was not statistically different during destratification. Depth distribution of zooplankton was generally unaffected, but Diaptomus spp. tended to occur in deeper water during the destratification year.

16673. Stickney, Robert R., and Daniel Perlmutter (Skidaway Inst. of Oceanog., Savannah, Georgia 31406). 1973. A TABLE FOR RAPID WASHING OF BENTHOS SAMPLES. Prog. Fish-Cult., 35(1): p. 26.

16674. Balazs, George H. (Hawaii Inst. of Marine Biol., Univ. of Hawaii, Kaneohe, Hawaii 96744). 1973. A SIMPLIFIED METHOD FOR IDENTIFYING EXPERIMENTAL SHRIMP. Prog. Fish-Cult., 35(1): p. 27.

16675. Rinne, William E., and James E. Deacon (Dept. of Biol. Sci., Univ. of Nevada, Las Vegas, Nevada 89109). 1973. FLUORESCENT PIGMENT AND IMMERSION STAIN MARKING TECHNIQUES FOR Lepidomeda mollispinis AND Cyprinodon nevadensis. Trans. Amer. Fish. Soc., 102(2): 459-462.

Two methods of marking immersion dyeing and spraying with fluorescent pigments, were tested for use on Lepidomeda mollispinis and Cyprinodon nevadensis. Three dyes were used: Bismarck Brown Y, Rhodamine B and Trypan Blue. All three were rejected for use on L. mollispinis because of poor marking consistency and severe stress. Bismarck Brown Y was found suitable for C. nevadensis for short-term mark and recapture experiments. Fluorescent pigment marking with compressed air produced permanent marks in both species but resulted in high mortality to C. nevadensis in the laboratory.

16676. Dendy, J. S. (Agr. Exp. Sta., Auburn Univ., Auburn, Alabama). 1971. PHENOLOGY OF MIDGES IN EXPERIMENTAL PONDS. Reprint from the Proc. of the 4th Internat'l Symposium on Chironomidae, The Canadian Entomologist, 103(3): 376-380.

Adult midges (Chironomidae: Diptera) were recorded at experimental ponds during all months. Data from 13 years were combined by months. Submerged traps yielded 50 species. Other methods of collecting obtained 15 additional species. Traps in 12 similar 0.1-ha ponds beside a permanent slow-flowing supply-canal yielded 45 species. Traps in a 1.95-ha pond that lacked such a canal yielded 15 species. (Auth.)

16677. Ackman, R. G., and D. Noble (Fish. Res. Bd. of Canada, Halifax Lab., Halifax, Nova Scotia, Canada). 1973. STEAM DISTILLATION: A SIMPLE TECHNIQUE FOR RECOVERY OF PETROLEUM HYDROCARBONS FROM TAINTED FISH. J. Fish. Res. Bd. Canada, 30(5): 711-714.

Simple steam distillation was found to be efficacious for isolation of hydrocarbons from contaminated whitefish. Gas-liquid chromatography on support-coated open-tubular Apiezon-L columns demonstrated that hydrocarbons recovered from the tainted fish had a composition pattern qualitatively similar in detail to that from a sample of diesel oil suspected as the source of contamination. (Authors)

16678. Gast, Marion H., and William A. Brungs (U.S. Environ. Protection Agency, Newtown Fish Toxicol. Lab., 3411 Church St., Cincinnati, Ohio 45244). 1973. A PROCEDURE FOR SEPARATING EGGS OF THE FATHEAD MINNOW. Prog. Fish-Cult., 35(1): p. 54.

16679. Spigarelli, S. A., G. P. Romberg, and R. E. Thorne (Radiological and Environ. Res. Div., Argonne Nat'l Lab., Argonne, Illinois 60439). 1973. A TECHNIQUE FOR SIMULTANEOUS ECHO LOCATION OF FISH AND THERMAL PLUME MAPPING. Trans. Amer. Fish. Soc., 102(2): 462-466.

Thermal plume mapping procedures developed at Argonne National Laboratory and echo location procedures developed at the University of Washington (College of Fisheries) were combined to provide a technique for fish distribution studies near thermal discharges. This pilot study was performed on Lake Michigan at the Point Beach Nuclear Power Station (Two Creeks, Wisconsin) on 28 October 1971. Reduction of fish distribution and temperature data from both day and night plume series showed striking diurnal changes in fish orientation. Many schools of fish were observed during the day series, while, at night, only individual fish were observed. The depth distribution of fish also differed between day and night: during the day, observed schools were deeper than individual fish, whereas at night, the individuals were at shallower depths. During both series: (1) fish were more numerous in the upstream side (relative to current) of the plume and (2) fish were more abundant in the cooler areas of the plume ($<15C$). Limitations of the technique include: (1) the restricted sampling volume of the fish locator; (2) possible bias due to fish avoidance of the vessel, and (3) the need for supplementary effort to determine species and size information.

16680. Caillouet, Charles W., Jr., and James B. Higman (Gulf Coastal Fish. Center, NMFS, Galveston, Texas 77550). 1972. SAMPLE SIZE IN SPORT FISHERY SURVEYS. Trans. Amer. Fish. Soc., 102(2): 466-468.

16681. Rawson, Mac V., and Wilmer A. Rogers (Coop. Fish. Unit, University of Ga., Athens, Georgia 30601). 1972. SEASONAL ABUNDANCE OF ANCYROCEPHALINAEN (MONOGENOIDEA) PARASITES OF BLUEGILL, Lepomis macrochirus (Raf). J. Wildlife Diseases, Vol. 8, pp. 255-260.

Nine species of Monogenea of the subjamily Ancyrocephalinae were collected from Lepomis macrochirus in Walter F. George Reservoir at 2 week intervals from December 1967 to January 1969. The abundance patterns and size of the organism formed three distinct groups: (1) the large species most abundant during the autumn and least abundant during the mid summer period were Anchoradiscus triangularis and Clavunculus bifurcatus; (2) the large species most abundant during the spring and least abundant during the mid summer period were Lyrodiscus seminolensis and Cleidodiscus robustus; and (3) the small species abundant during the summer but having a prewinter peak at water temperatures near 10C were Actinocleidus fergusoni, Urocleidus dispar, U. ferox, U. acer and Cleidodiscus nematocirrus. (Authors)

16682. Reed, J. R., F. B. Blood, and G. L. Samsel (Dept. of Biol., Va. Commonwealth Univ., Richmond, Virginia 23220). 1973. A LOW-COST HEATED RACEWAY FOR FISH CULTURE STUDIES. Prog. Fish-Cult., 35(1): p. 60.

16683. Icanberry, John W., and Roland W. Richardson (Pacific Gas & Electric Co., San Ramon, California 94583). 1973. QUANTITATIVE SAMPLING OF LIVE ZOOPLANKTON IN A FILTER-PUMP SYSTEM. L. & O., 18(2): 333-335.

A conventional plankton net was inadequate for study of the survival of zooplankton passing through the cooling water system of thermal power plants. A filter collection system was designed which allows survivals of 90-95% by reducing water velocities and turbulence within the collection chamber. Comparisons of fishing abilities did not show any significant differences between a filter pump and a plankton net. (Authors)

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